

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As the below named inventor, I hereby declare that:

My residence, post office address and citizenship is as stated below next to my name;

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

NUCLEIC ACIDS AND PROTEINS FROM GROUP B STREPTOCOCCUS

the specification of which: ☒ is attached hereto.
☐ was filed on: _____
as Application No.: _____
and was amended on: _____ (if applicable).

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56.

And I hereby authorize and request our agents, Brobeck, Phleger & Harrison LLP, whose address is set forth below, to insert above, the filing date and application number of said application when known.

Prior Foreign Application(s)

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application(s) for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Country	Application Number	Date of Filing (day, month, year)	Date of Issue (day, month, year)	Priority Claimed	
German	9816335.5	July 27, 1998		Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
				Yes <input type="checkbox"/>	No <input type="checkbox"/>

Prior Provisional Application(s)

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below:

Application Number	Date of Filing (day, month, year)
60/125,163	March 19, 1999

Prior United States Application(s)

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Number	Date of Filing (day, month, year)	Status - Patented, Pending, Abandoned
PCT/GB99/02444	27 July 1999	Pending

And I hereby appoint, both jointly and severally, as my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith the following attorneys, their registration numbers being listed after their names:

Rodger L. Tate, Registration No. 27,399; Anthony W. Shaw, Registration No. 30,104; James Remenick, Registration No. 36,902; Michael J. Songer, Reg. No. 39,841; Cono A. Carrano, Registration No. 39,623; Laurence H. Posorske, Registration No. 34,698; Floyd B. Chapman, Registration No. 40,555; David J. Kulik, Registration No. 36,576; Robert A. King, Registration No. 42,738; and Trevor Q. Coddington, Registration No. 46,633.

All correspondence and telephone communications should be addressed to: Brobeck, Phleger & Harrison LLP; Intellectual Property Department; 1333 H Street, N.W.; Suite 800; Washington, DC 20005; telephone number (202) 220-6000; facsimile number (202) 220-5200, which is also the address, telephone and facsimile numbers of each of the above listed attorneys.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and imprisonment, or both, under 18 U.S.C. § 1001, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Signature _____ Date _____

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Residence: Cambridge, United Kingdom

Post Office
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Signature _____ Date _____

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Citizenship: United Kingdom

Residence: Norwich, United Kingdom

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Signature _____ Date _____

Full Name of
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(Family Name) (First Given Name) (Second Given Name)

Citizenship: Ireland

Residence: Cambridge, United Kingdom

Post Office
Address: c/o University of Cambridge, Department of Pathology, Tennis Court Road
Cambridge CB2 1QP, United Kingdom

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)
)
Christophe Francois Guy GILBERT et al.) Group Art Unit: To Be Assigned
)
Application Number: To Be Assigned) Examiner: To Be Assigned
)
Filed: January 26, 2001)
)
For: NUCLEIC ACIDS AND PROTEINS FROM GROUP B STREPTOCOCCUS

SUBMISSION OF SEQUENCE LISTING

Commissioner for Patents
Washington, D.C. 20231

Sir:

Applicants submit herewith a paper copy of the Sequence Listing as filed in parent application number PCT/GB99/02444 filed July 27, 1999. The Sequence Listing in this application is identical to the Sequence Listing submitted in the parent application.

Applicants respectfully submit that it is unnecessary to file a computer readable form of the Sequence Listing, since it would be a duplicate of the computer readable form submitted in parent application number PCT/GB99/02444. Therefore, in accordance with 37 C.F.R. §1.821(e), no computer readable form is enclosed.

Applicants herewith request that the computer readable form submitted in parent application number PCT/GB99/02444 be used in this application. The undersigned certifies his belief that the computer readable form submitted in the parent application is identical in content to the paper copy of the Sequence Listing enclosed herewith.

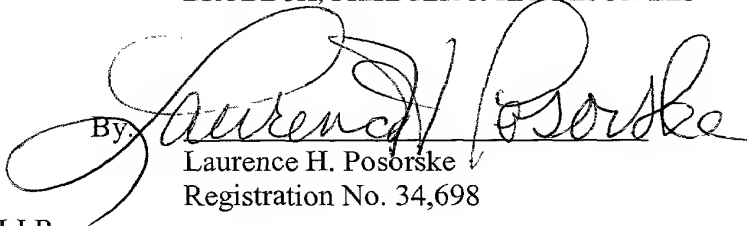
11/11/99 10:00 AM

It is believed that no fees are required for this submission; however, the Commissioner is authorized to charge any fee necessary for entry of this paper to Deposit Account 50-1640.

Respectfully submitted,

BROBECK, PHLEGER & HARRISON LLP

January 26, 2001

By 
Laurence H. Posorske
Registration No. 34,698

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LHP:nej

SEQUENCE LISTING

<110> Microbial Technics Limited

Le Page, Richard WF

Wells, Jeremy M

Hanniffy, Sean B

Hansbro, Philip M

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<150> GB 9816336.3

<151> 1998-07-27

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<213> Streptococcus pneumoniae

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25

30

Gly Ile Ser Val Gly Ile Gly His Leu Gln Gly Ser Ser Met Ala Lys

35

40

45

Asn Asn Lys Val Ala Val Val Thr Thr Val Pro Ser Val Ala Glu Gly

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55

60

Leu Lys Asn Val Asn Gly Val Asn Phe Asp Tyr Lys Asp Glu Ala Ser

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70

75

80

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 290 295 300

Ile Leu Ile Met Gly Gly Phe Phe Gly Val Thr Ala Leu Gly Ala Ala
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Gly Asp Asn Leu Leu Leu Lys Ile Gly Ser Tyr Ile Pro Phe Ile Ser
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Thr Phe Phe Met Pro Phe Arg Thr Ile Asn Asp Tyr Ala Gly Gly Ala
 340 345 350

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<213> Streptococcus pneumoniae

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Gly Gly Pro Arg Pro Thr Ile Val Glu Gly Lys Gly Lys Trp Ala Glu
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Thr Leu His Leu Val Glu Glu Asn Met Phe Gly Ser Ser Ile Ala Asn
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Tyr Arg Asn Ser Ser Glu Asp Arg Tyr Val Ser Ser Ile Phe His Gly
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 195 200 205

Leu Gly Arg Thr Glu Asp Asn Asp Ile His Tyr Arg Ile Arg Glu Tyr
 210 215 220

Gly Tyr Lys Ile Arg Tyr Ser Pro Ser Ile Leu Ser Tyr Gln Tyr Ile
 225 230 235 240

Arg Pro Thr Phe Lys Lys Met Leu His Gln Lys Tyr Ser Asn Gly Leu
 245 250 255

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 260 265 270

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Leu Leu Pro Ile Thr Phe Val Phe Ile Thr Leu Leu Leu Gly Ala Tyr
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Phe Leu Leu Leu Ser Leu Leu Thr Leu Leu Thr Leu Leu Lys His Lys
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Asn Gly Phe Leu Ile Val Met Pro Phe Ile Leu Phe Ser Ile His Phe
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<212> DNA

<213> Streptococcus pneumoniae

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Lys Asp Tyr Arg Glu Ile Ile Leu Ser Gln Asp Val Leu Glu Glu Val
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Val Ser Asp Leu Lys Leu Asp Leu Thr Pro Lys Gly Leu Ala Asn Lys
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Ile Lys Val Thr Val Pro Val Asp Thr Arg Ile Val Ser Ile Ser Val
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Asn Asp Arg Val Pro Glu Glu Ala Ser Arg Ile Ala Asn Ser Leu Arg
 130 135 140

Glu Val Ala Ala Gln Lys Ile Ile Ser Ile Thr Arg Val Ser Asp Val
 145 150 155 160

Thr Thr Leu Glu Glu Ala Arg Pro Ala Ile Ser Pro Ser Ser Pro Asn
 165 170 175

Ile Lys Arg Asn Thr Leu Ile Gly Phe Leu Ala Gly Val Ile Gly Thr
 180 185 190

Ser Val Ile Val Leu His Leu Glu Leu Leu Asp Thr Arg Val Lys Arg
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<213> *Streptococcus pneumoniae*

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Val Leu Pro Gly Gly Met Pro Gly Ser Ala His Leu Arg Asp Asn Gln
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Thr Leu Ile Gln Glu Leu Gln Ser Phe Glu Gln Glu Gly Lys Lys Leu
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Ala Ala Ile Cys Ala Ala Pro Ile Ala Leu Asn Gln Ala Glu Ile Leu
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Lys Asn Lys Arg Tyr Thr Cys Tyr Asp Gly Val Gln Glu Gln Ile Leu
115 120 125

Asp Gly His Tyr Val Lys Glu Thr Val Val Val Asp Gly Gln Leu Thr
130 135 140

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Leu Glu Thr Thr Lys Lys Leu Pro Thr Thr Asn Glu Gln Leu Gln Ala
      35              40             45

Val Arg Leu Ser Gly Leu Val Asn Arg Glu Leu Leu Leu Asn Pro Lys
      50              55             60

His Pro Ala Pro Glu Leu Leu Asn Leu Ala Arg Phe Val Lys Arg Glu
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<213> *Streptococcus pneumoniae*

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Met Ser Lys Glu Pro Val Tyr Asp Ser Arg Thr Glu Lys Leu Thr Phe
 50 55 60

Gly Lys Glu Val Glu Asn Leu Glu Ile Thr Leu His Gln His Thr Leu
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Thr Ile Thr Asp Ser Phe Asp Asp Gln Ile His Ile Ser Tyr His Pro
 85 90 95

Ser Leu Ser Ala His His Asp Leu Ile Thr Asn Gln Asn Asp Arg Thr
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Leu Ser Leu Thr Asp Lys Lys Leu Ser Glu Thr Pro Phe Leu Ser Ser
 115 120 125

Gly Ile Gly Gly Ile Leu His Ile Ala Ser Ser Tyr Ser Ser Arg Phe
 130 135 140

Glu Glu Val Ile Leu Arg Leu Pro Lys Gly Arg Thr Leu Lys Gly Ile
 145 150 155 160

Asn Ile Ser Ala Asn Arg Gly Gln Thr Thr Ile Ile Asn Ala Ser Leu
 165 170 175

Glu Asn Ala Thr Leu Asn Thr Asn Ser Tyr Ile Leu Arg Ile Glu Gly
 180 185 190

Ser Arg Ile Lys Asn Ser Lys Leu Thr Thr Pro Asn Ile Val Asn Ile
 195 200 205

Phe Asp Thr Val Leu Thr Asp Ser Gln Leu Glu Ser Thr Glu Asn His
 210 215 220

Phe His Ala Glu Asn Ile Gln Val His Gly Lys Val Glu Leu Thr Ala
 225 230 235 240

Lys Asp Tyr Leu Arg Ile Ile Leu Asp Gln Lys Glu Ser Gln Arg Ile
 245 250 255

Asn Trp Asp Ile Ser Ser Asn Tyr Gly Ser Ile Phe Gln Phe Thr Arg
 260 265 270

Glu Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr
 275 280 285

Glu Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn
 290 295 300

Ile Asp Leu Ile Ser Thr Pro Ser Arg Arg
 305 310

<210> 13

<211> 879

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 13

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 agccagcaag aagagaaaaat tgaagctcct gaagacagtg aagcgagaac agaaatagaa 240
 gaaaagaagg catctaattc tactgaagaa gagccagacc tttctaaaga aacagaaaaa 300
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 attctgtttt ctgcatcttc ctttttcttt agtatctatc acatcaaaca tgcttactat 600
 ggacatatag caagcattaa cagtcgcttc cctgagcagc tagctccttt aactcttttt 660
 tctatcatct ctatcctagt agcgacaaca ctcttcttct tttcattcct cttgggtagt 720

ttcgttgatga gacgatttat ccaccaggaa aaggactgga cgctagacaa ggttctccaa 780
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 tctttgatag cctacgattt acagccctct tgtgtgtga 879

<210> 14

<211> 292

<212> PRT

<213> Streptococcus pneumoniae

<400> 14

Met Lys Gln Glu Trp Phe Glu Ser Asn Asp Phe Val Lys Thr Thr Ser
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Lys Asn Lys Pro Glu Glu Gln Ala Gln Glu Val Ala Asp Lys Ala Glu
 20 25 30

Glu Thr Ile Ala Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu
 35 40 45

Glu Glu Glu Val Pro Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu
 50 55 60

Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu
 65 70 75 80

Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys
 85 90 95

Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro
 100 105 110

Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu
 115 120 125

Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp
 130 135 140

Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys
 145 150 155 160

Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala
 165 170 175

Phe Leu Leu Leu Ile Leu Phe Ser Ala Ser Ser Phe Phe Phe Ser Ile
 180 185 190

Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser
 195 200 205

Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser
 210 215 220

Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser
 225 230 235 240

Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp
 245 250 255

Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser
 260 265 270

Leu Leu Leu Leu Val Ser Leu Leu Ser Leu Ile Ala Tyr Asp Leu Gln
 275 280 285

Pro Ser Cys Val
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<210> 15

<211> 990

<212> DNA

<213> Streptococcus pneumoniae

<400> 15

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 actaccgtta tcggctttat cctgcttttt gtaggtatcc aatctgacgg gattaagagc 180
 ctactttcca tgtccaaaga acctgtctat gatagccgta cggaaaagct aacctttggc 240
 aaggaagtcg aaaacctaga aattactctc caccaacaca cgctcaccat cacagactct 300
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 accaatcaga acgatagaac tctgagtctc actgataaga aactgtctga aactccgttt 420
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<210> 16

<211> 329

<212> PRT

<213> Streptococcus pneumoniae

<400> 16

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1

5

10

15

Phe Leu Lys Lys Glu Arg Glu Val Ile Ser Met Arg Lys Trp Thr Lys

20

25

30

Gly Phe Leu Ile Phe Gly Val Val Thr Thr Val Ile Gly Phe Ile Leu

35

40

45

Leu Phe Val Gly Ile Gln Ser Asp Gly Ile Lys Ser Leu Leu Ser Met

50

55

60

Ser Lys Glu Pro Val Tyr Asp Ser Arg Thr Glu Lys Leu Thr Phe Gly
65 70 75 80

Lys Glu Val Glu Asn Leu Glu Ile Thr Leu His Gln His Thr Leu Thr
85 90 95

Ile Thr Asp Ser Phe Asp Asp Gln Ile His Ile Ser Tyr His Pro Ser
100 105 110

Leu Ser Ala His His Asp Leu Ile Thr Asn Gln Asn Asp Arg Thr Leu
115 120 125

Ser Leu Thr Asp Lys Lys Leu Ser Glu Thr Pro Phe Leu Ser Ser Gly
130 135 140

Ile Gly Gly Ile Leu His Ile Ala Ser Ser Tyr Ser Ser Arg Phe Glu
145 150 155 160

Glu Val Ile Leu Arg Leu Pro Lys Gly Arg Thr Leu Lys Gly Ile Asn
165 170 175

Ile Ser Ala Asn Arg Gly Gln Thr Thr Ile Ile Asn Ala Ser Leu Glu
180 185 190

Asn Ala Thr Leu Asn Thr Asn Ser Tyr Ile Leu Arg Ile Glu Gly Ser
195 200 205

Arg Ile Lys Asn Ser Lys Leu Thr Thr Pro Asn Ile Val Asn Ile Phe
210 215 220

Asp Thr Val Leu Thr Asp Ser Gln Leu Glu Ser Thr Glu Asn His Phe
225 230 235 240

His Ala Glu Asn Ile Gln Val His Gly Lys Val Glu Leu Thr Ala Lys
245 250 255

Asp Tyr Leu Arg Ile Ile Leu Asp Gln Lys Glu Ser Gln Arg Ile Asn
260 265 270

Trp Asp Ile Ser Ser Asn Tyr Gly Ser Ile Phe Gln Phe Thr Arg Glu
 275 280 285

Lys Pro Glu Ser Arg Gly Thr Glu Leu Ser Asn Pro Tyr Lys Thr Glu
 290 295 300

Lys Thr Asp Val Lys Asp Gln Leu Ile Ala Arg Ser Asp Asp Asn Ile
 305 310 315 320

Asp Leu Ile Ser Thr Pro Ser Arg Arg
 325

<210> 17

<211> 79

<212> DNA

<213> Streptococcus pneumoniae

<400> 17

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 ggacgctgct attttaatc 79

<210> 18

<211> 26

<212> PRT

<213> Streptococcus pneumoniae

<400> 18

Met Ile Cys Lys Met Lys Gln Gly Gly Ser Arg Ala Cys Trp Gly Trp
 1 5 10 15

Arg Val Gly Glu Gly Arg Cys Tyr Phe Asn
 20 25

<210> 19

<211> 715

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 19

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taaacgaaag attggctacg tagcagactc gcctgactta tttttacgct taacggccaa 240
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ttgtggtaag gtagaggact tgaggaaaga ccaccagac cagtctttgg aaagtatcta 660
ccttagtctt gctggtagaa aagaggaggt tgcggatgcg tctcaaggtc attaa      715

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<210> 20

<211> 237

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 20

Asp Lys Glu Ala Leu Ser Asn Leu Asn Leu Gln Ile Glu Asn Gly Glu

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15

Ile Met Gly Leu Ile Gly His Asn Gly Ala Gly Lys Ser Thr Thr Ile

20

25

30

Lys Ser Leu Val Ser Ile Ile Ser Pro Ser Ser Gly Arg Ile Leu Val

35

40

45

Asp Gly Gln Glu Leu Ser Glu Asn Arg Leu Ala Ile Lys Arg Lys Ile

50

55

60

Gly Tyr Val Ala Asp Ser Pro Asp Leu Phe Leu Arg Leu Thr Ala Asn
 65 70 75 80

Glu Phe Trp Glu Leu Ile Ala Ser Ser Tyr Asp Leu Ser Arg Ser Asp
 85 90 95

Leu Glu Ala Ser Leu Ala Arg Leu Leu Asn Val Phe Asp Phe Ala Glu
 100 105 110

Asn Arg Tyr Gln Val Ile Glu Thr Leu Ser His Gly Met Arg Gln Lys
 115 120 125

Val Phe Val Ile Gly Ala Leu Leu Ser Asp Pro Asp Ile Trp Val Leu
 130 135 140

Asp Glu Pro Leu Thr Gly Leu Asp Pro Gln Ala Ala Phe Asp Leu Lys
 145 150 155 160

Gln Met Met Lys Glu His Ala Gln Lys Gly Lys Thr Val Leu Phe Ser
 165 170 175

Thr His Val Leu Glu Val Ala Glu Gln Val Cys Asp Arg Ile Ala Ile
 180 185 190

Leu Lys Lys Gly His Leu Ile Tyr Cys Gly Lys Val Glu Asp Leu Arg
 195 200 205

Lys Asp His Pro Asp Gln Ser Leu Glu Ser Ile Tyr Leu Ser Leu Ala
 210 215 220

Gly Arg Lys Glu Glu Val Ala Asp Ala Ser Gln Gly His
 225 230 235

<210> 21

<211> 360

<212> DNA

<213> Streptococcus pneumoniae

<400> 21

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tgttgccagt tttcagaaaag aatttttagca acttggctaa agaaactact gctagtctct 180
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tcattctttt aaatggtttc aatgctggca ttgatttggc taatacgatt gtcattttta 300
cgaagcccg tagcgatagc tgtatcttct tccccagttt tgaaaccagg ttctacttga 360
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<210> 22

<211> 119

<212> PRT

<213> Streptococcus pneumoniae

<400> 22

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Met Ala Leu Phe Ser Glu Arg Gly Ala Val Arg Lys Thr Pro Met Ala
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Ser Pro Ile Met Arg Pro Met Met Val Pro Thr Ile Glu Ile Lys Arg
      20             25             30
```

```
Val Ile Pro Ala Pro Arg Lys Ser Cys Cys Gln Phe Ser Glu Arg Ile
      35             40             45
```

```
Leu Ala Thr Trp Leu Lys Lys Leu Leu Leu Val Ser Ser Val Val Val
      50             55             60
```

```
Ala Ser Ala Gly Cys Ser Leu Ile Ile Arg Ser Ile Lys Ala Thr Trp
      65             70             75             80
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Ser Ser Phe Glu Met Val Ser Met Leu Ala Leu Ile Trp Leu Ile Arg
      85             90             95
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Leu Ser Phe Leu Arg Ser Pro Ile Ala Ile Ala Val Ser Ser Ser Pro
 100 105 110

Val Leu Lys Pro Gly Ser Thr
 115

<210> 23

<211> 1455

<212> DNA

<213> Streptococcus pneumoniae

<400> 23

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 tatgtggatg gcagccagtc aagtcagaaa agtgaaaact tgacaccaga ccagggttagc 180
 cagaaagaag gaattcaggc tgagcaaat gtaatcaaaa ttacagatca gggctatgta 240
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 agtgaagaac tcttgatgaa ggatccaaac tatcaactta aagacgctga tattgtcaat 360
 gaagtcaagg gtgggttatat catcaaggtc gatggaaaat attatgtcta cctgaaagat 420
 gcagctcatg ctgataatgt tcgaactaaa gatgaaatca atcgtcaaaa acaagaacat 480
 gtcaaagata atgagaaggt taactctaata gttgctgtag caagggtctca gggacgatat 540
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 gaattagcag cagctaaagc acatctggct ggaaaaaata tgcaaccgag tcagttaagc 720
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cgcaaaaaca tttag

1455

<210> 24

<211> 484

<212> PRT

<213> Streptococcus pneumoniae

<400> 24

Met Lys Phe Ser Lys Lys Tyr Ile Ala Ala Gly Ser Ala Val Ile Val

1

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10

15

Ser Leu Ser Leu Cys Ala Tyr Ala Leu Asn Gln His Arg Ser Gln Glu

20

25

30

Asn Lys Asp Asn Asn Arg Val Ser Tyr Val Asp Gly Ser Gln Ser Ser

35

40

45

Gln Lys Ser Glu Asn Leu Thr Pro Asp Gln Val Ser Gln Lys Glu Gly

50

55

60

Ile Gln Ala Glu Gln Ile Val Ile Lys Ile Thr Asp Gln Gly Tyr Val

65

70

75

80

Thr Ser His Gly Asp His Tyr His Tyr Tyr Asn Gly Lys Val Pro Tyr

85

90

95

Asp Ala Leu Phe Ser Glu Glu Leu Leu Met Lys Asp Pro Asn Tyr Gln

100

105

110

Leu Lys Asp Ala Asp Ile Val Asn Glu Val Lys Gly Gly Tyr Ile Ile

115

120

125

Lys Val Asp Gly Lys Tyr Tyr Val Tyr Leu Lys Asp Ala Ala His Ala

130

135

140

Asp Asn Val Arg Thr Lys Asp Glu Ile Asn Arg Gln Lys Gln Glu His

145

150

155

160

Val Lys Asp Asn Glu Lys Val Asn Ser Asn Val Ala Val Ala Arg Ser
 165 170 175

Gln Gly Arg Tyr Thr Thr Asn Asp Gly Tyr Val Phe Asn Pro Ala Asp
 180 185 190

Ile Ile Glu Asp Thr Gly Asn Ala Tyr Ile Val Pro His Gly Gly His
 195 200 205

Tyr His Tyr Ile Pro Lys Ser Asp Leu Ser Ala Ser Glu Leu Ala Ala
 210 215 220

Ala Lys Ala His Leu Ala Gly Lys Asn Met Gln Pro Ser Gln Leu Ser
 225 230 235 240

Tyr Ser Ser Thr Ala Ser Asp Asn Asn Thr Gln Ser Val Ala Lys Gly
 245 250 255

Ser Thr Ser Lys Pro Ala Asn Lys Ser Glu Asn Leu Gln Ser Leu Leu
 260 265 270

Lys Glu Leu Tyr Asp Ser Pro Ser Ala Gln Arg Tyr Ser Glu Ser Asp
 275 280 285

Gly Leu Val Phe Asp Pro Ala Lys Ile Ile Ser Arg Thr Pro Asn Gly
 290 295 300

Val Ala Ile Pro His Gly Asp His Tyr His Phe Ile Pro Tyr Ser Lys
 305 310 315 320

Leu Ser Ala Leu Glu Glu Lys Ile Ala Arg Met Val Pro Ile Ser Gly
 325 330 335

Thr Gly Ser Thr Val Ser Thr Asn Ala Lys Pro Asn Glu Val Val Ser
 340 345 350

Ser Leu Gly Ser Leu Ser Ser Asn Pro Ser Ser Leu Thr Thr Ser Lys
 355 360 365

Glu Leu Ser Ser Ala Ser Asp Gly Tyr Ile Phe Asn Pro Lys Asp Ile
 370 375 380

Val Glu Glu Thr Ala Thr Ala Tyr Ile Val Arg His Gly Asp His Phe
 385 390 395 400

His Tyr Ile Pro Lys Ser Asn Gln Ile Gly Gln Pro Thr Leu Pro Asn
 405 410 415

Asn Ser Leu Ala Thr Pro Ser Pro Ser Leu Pro Ile Asn Pro Gly Thr
 420 425 430

Ser His Glu Lys His Glu Glu Asp Gly Tyr Gly Phe Asp Ala Asn Arg
 435 440 445

Ile Ile Ala Glu Asp Glu Ser Gly Phe Val Met Ser His Gly Asp His
 450 455 460

Asn His Tyr Phe Phe Lys Lys Asp Leu Thr Glu Glu Gln Ile Lys Val
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Arg Lys Asn Ile

<210> 25

<211> 840

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 25

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<210> 26

<211> 279

<212> PRT

<213> Streptococcus pneumoniae

<400> 26

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1

5

10

15

Pro Leu Ala Ser Ala Ala Leu Ser Asp Val Ser Leu Thr Ile Glu Asp

20

25

30

Gly Ser Tyr Thr Ala Leu Ile Gly His Thr Gly Ser Gly Lys Ser Thr

35

40

45

Ile Leu Gln Leu Leu Asn Gly Leu Leu Val Pro Ser Gln Gly Ser Val

50

55

60

Arg Val Phe Asp Thr Leu Ile Thr Ser Thr Ser Lys Asn Lys Asp Ile

65

70

75

80

Arg Gln Ile Arg Lys Gln Val Gly Leu Val Phe Gln Phe Ala Glu Asn

85

90

95

Gln Ile Phe Glu Glu Thr Val Leu Lys Asp Val Ala Phe Gly Pro Gln

100

105

110

Asn Phe Gly Val Ser Glu Glu Asp Ala Val Lys Thr Ala Arg Glu Lys
 115 120 125

Leu Ala Leu Val Gly Ile Asp Glu Ser Leu Phe Asp Arg Ser Pro Phe
 130 135 140

Glu Leu Ser Gly Gly Gln Met Arg Arg Val Ala Ile Ala Gly Ile Leu
 145 150 155 160

Ala Met Glu Pro Ala Ile Leu Val Leu Asp Glu Pro Thr Ala Gly Leu
 165 170 175

Asp Pro Leu Gly Arg Lys Glu Leu Met Thr Leu Phe Lys Lys Leu His
 180 185 190

Gln Ser Gly Met Thr Ile Val Leu Val Thr His Leu Met Asp Asp Val
 195 200 205

Ala Glu Tyr Ala Asn Gln Val Tyr Val Met Glu Lys Gly Arg Leu Val
 210 215 220

Lys Gly Gly Lys Pro Ser Asp Val Phe Gln Asp Val Val Phe Met Glu
 225 230 235 240

Glu Val Gln Leu Gly Val Pro Lys Ile Thr Ala Phe Cys Lys Arg Leu
 245 250 255

Ala Asp Arg Gly Val Ser Phe Lys Arg Leu Pro Ile Lys Ile Glu Glu
 260 265 270

Phe Lys Glu Ser Leu Asn Gly
 275

<210> 27

<211> 6360

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 27

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<212> PRT

<213> Streptococcus pneumoniae

<400> 28

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Glu Thr Thr Pro Asp Asn Leu Asp Lys Ile Lys Gln Ile Glu Gly Ile
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Ser Ser Val Glu Arg Ala Gln Lys Val Gln Pro Met Met Asn His Ala
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Arg Lys Glu Ile Gly Val Glu Glu Ala Ile Asp Tyr Leu Lys Ser Ile
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Asn Ile Asp Thr Gly Thr Asp Tyr Arg His Lys Ala Met Arg Ile Asp
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Asp Asp Ala Lys Ala Ser Met Arg Phe Lys Lys Glu Asp Leu Lys Gly
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Thr Asp Lys Asn Tyr Trp Leu Ser Asp Lys Ile Pro His Ala Phe Asn
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Tyr Tyr Asn Gly Gly Lys Ile Thr Val Glu Lys Tyr Asp Asp Gly Arg
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Asp Tyr Phe Asp Pro His Gly Met His Ile Ala Gly Ile Leu Ala Gly
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Ala Pro Asn Ala Gln Ile Phe Ser Tyr Lys Met Tyr Ser Asp Ala Gly
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Thr Gly Leu Val Gly Glu Lys Tyr Trp Gln Ala Ile Arg Ala Leu Arg
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Lys Ala Gly Ile Pro Met Val Val Ala Thr Gly Asn Tyr Ala Thr Ser
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Ala Ser Ser Ser Ser Trp Asp Leu Val Ala Asn Asn His Leu Lys Met
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Ala Val Ala Ser Ala Lys Asn Gln Thr Val Glu Phe Asp Lys Val Asn
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Lys Ser Lys Ile Thr Thr Asn Glu Asp Gly Thr Lys Ala Pro Ser Lys
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Asp Leu Lys Asn Ala Phe Lys Lys Ala Met Asp Lys Gly Ala Arg Ala
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Lys Asp Lys Leu Glu Gln Tyr Tyr Pro Ile Asp Met Glu Ser Phe Asn
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Ser Asn Lys Pro Asn Val Gly Asp Glu Lys Glu Ile Asp Phe Lys Phe
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Ala Pro Asp Thr Asp Lys Glu Leu Tyr Lys Glu Asp Ile Ile Val Pro
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Asp Val Ser Ala Pro Gly Lys Asn Ile Lys Ser Thr Leu Asn Val Ile
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Asn Gly Lys Ser Thr Tyr Gly Tyr Met Ser Gly Thr Ser Met Ala Thr
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Met Met Asp Ala Thr Ser Trp Lys Glu Lys Ser Gln Tyr Phe Ala Ser
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Pro Arg Gln Gln Gly Ala Gly Leu Ile Asn Val Ala Asn Ala Leu Arg
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Asn Ser Tyr Gly Ser Ile Ser Leu Lys Glu Ile Lys Gly Asp Lys Lys
 770 775 780

Tyr Phe Thr Ile Lys Leu His Asn Thr Ser Asn Arg Pro Leu Thr Phe
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995 1000 1005

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Lys Glu His Pro Glu Lys Phe Asp Glu Ile Ala Asn Glu Val Trp Tyr
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Glu Val Thr Tyr Ala Gly Glu Gly Gln Gly Arg Asn Arg Lys Leu Asp
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Lys Asp Gly Asn Thr Ile Tyr Glu Ile Lys Gly Ala Gly Asp Leu Arg
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Lys Ile His Arg Ile Lys Phe Ala Asn Gln Ala Asp Glu Lys Gly Met
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Ile Ser Tyr Tyr Leu Val Asp Pro Asp Gln Asp Ser Ser Lys Tyr Gln
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Lys Leu Gly Glu Ile Ala Glu Ser Lys Phe Lys Asn Leu Gly Asn Gly
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Lys Glu Gly Ser Leu Lys Lys Asp Thr Thr Gly Val Glu His His His
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Gln Glu Asn Glu Glu Ser Ile Lys Glu Lys Ser Ser Phe Thr Ile Asp
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Arg Asn Ile Ser Thr Ile Arg Asp Phe Glu Asn Lys Asp Leu Lys Lys
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Gly Lys Arg Met Glu Glu Tyr Asp Tyr Lys Tyr Asp Asp Lys Gly Asn
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Ile Ile Ala Tyr Asp Asp Gly Thr Asp Leu Glu Tyr Glu Thr Glu Lys
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Ala Lys Val Tyr Tyr Gly Asn Asn Tyr Lys Ser Ile Glu Ile Lys Ala
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Phe Pro Asp Lys Val Thr Asp Met Asp Gly Asn Val Tyr Leu Gln Thr
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Gly Tyr Ser Asp Leu Asn Ala Lys Ala Val Gly Val His Tyr Gln Phe
 1825 1830 1835 1840

Leu Tyr Asp Asn Val Lys Pro Glu Val Asn Ile Asp Pro Lys Gly Asn
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Thr Ser Ile Glu Tyr Ala Asp Gly Lys Ser Val Val Phe Asn Ile Asn
 1860 1865 1870

Asp Lys Arg Asn Asn Gly Phe Asp Gly Glu Ile Gln Glu Gln His Ile
 1875 1880 1885

Tyr Ile Asn Gly Lys Glu Tyr Thr Ser Phe Asn Asp Ile Lys Gln Ile
 1890 1895 1900

Ile Asp Lys Thr Leu Asn Ile Lys Ile Val Val Lys Asp Phe Ala Arg
 1905 1910 1915 1920

Asn Thr Thr Val Lys Glu Phe Ile Leu Asn Lys Asp Thr Gly Glu Val
 1925 1930 1935

Ser Glu Leu Lys Pro His Arg Val Thr Val Thr Ile Gln Asn Gly Lys
 1940 1945 1950

Glu Met Ser Ser Thr Ile Val Ser Glu Glu Asp Phe Ile Leu Pro Val
 1955 1960 1965

Tyr Lys Gly Glu Leu Glu Lys Gly Tyr Gln Phe Asp Gly Trp Glu Ile
 1970 1975 1980

Ser Gly Phe Glu Gly Lys Lys Asp Ala Gly Tyr Val Ile Asn Leu Ser
 1985 1990 1995 2000

Lys Asp Thr Phe Ile Lys Pro Val Phe Lys Lys Ile Glu Glu Lys Lys
 2005 2010 2015

Glu Glu Glu Asn Lys Pro Thr Phe Asp Val Ser Lys Lys Lys Asp Asn
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Pro Gln Val Asn His Ser Gln Leu Asn Glu Ser His Arg Lys Glu Asp
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Leu Gln Arg Glu Glu His Ser Gln Lys Ser Asp Ser Thr Lys Asp Val
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Thr Ala Thr Val Leu Asp Lys Asn Asn Ile Ser Ser Lys Ser Thr Thr
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<213> Streptococcus pneumoniae

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Glu Lys Asn Ala Glu Leu Ala Lys Leu Ala Tyr Gly Ser Asn Phe Glu
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Gln Val Ser Ser Ala Pro Val Thr Ile Ala Leu Phe Thr Asp Thr Asp
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Phe Ala Arg Tyr Ser Glu Gln Gln Val Ser Asp Tyr Leu Ala Leu Asn
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25

30

Asp Ser Lys Ala Asp Ala Gln His Pro Phe Gly Pro Gly Pro Val Lys

35

40

45

Ala Leu Glu Lys Phe Leu Glu Ile Ala Asp Arg Asp Gly Tyr Pro Thr

50

55

60

Lys Asn Val Asp Asn Tyr Ala Gly His Phe Glu Phe Gly Asp Gly Glu

65

70

75

80

Glu Val Leu Gly Ile Phe Ala His Met Asp Val Val Pro Ala Gly Ser

85

90

95

Gly Trp Asp Thr Asp Pro Tyr Thr Pro Thr Ile Lys Asp Gly Arg Leu

100

105

110

Tyr Ala Arg Gly Ala Ser Asp Asp Lys Gly Pro Thr Thr Ala Cys Tyr

115

120

125

Tyr Gly Leu Lys Ile Ile Lys Glu Leu Gly Leu Pro Thr Ser Lys Lys

130

135

140

Val Arg Phe Ile Val Gly Thr Asp Glu Glu Ser Gly Trp Ala Asp Met

145

150

155

160

Asp Tyr Tyr Phe Glu His Val Gly Leu Ala Lys Pro Asp Phe Gly Phe
 165 170 175

Ser Pro Asp Ala Glu Phe Pro Ile Ile Asn Gly Glu Lys Gly Asn Ile
 180 185 190

Thr Glu Tyr Leu His Phe Ala Gly Glu Asn Thr Gly Val Ala Arg Leu
 195 200 205

His Ser Phe Thr Gly Gly Leu Arg Glu Asn Met Val Pro Glu Ser Ala
 210 215 220

Thr Ala Val Val Ser Gly Asp Leu Ala Asp Leu Gln Ala Lys Leu Asp
 225 230 235 240

Ala Phe Val Ala Glu His Lys Leu Arg Gly Glu Leu Gln Glu Glu Ala
 245 250 255

Gly Lys Tyr Lys Val Thr Ile Ile Gly Lys Ser Ala His Gly Ala Met
 260 265 270

Pro Ala Ser Gly Val Asn Gly Ala Thr Tyr Leu Ala Leu Phe Leu Ser
 275 280 285

Gln Phe Gly Phe Ala Gly Pro Ala Lys Asp Tyr Leu Asp Ile Ala Gly
 290 295 300

Lys Ile Leu Leu Asn Asp His Glu Gly Glu Asn Leu Lys Ile Ala His
 305 310 315 320

Val Asp Glu Lys Met Gly Ala Leu Ser Met Asn Ala Gly Val Phe His
 325 330 335

Phe Asp Glu Thr Ser Ala Asp Asn Thr Ile Ala Leu Asn Ile Arg Tyr
 340 345 350

Pro Lys Gly Thr Ser Pro Glu Gln Ile Lys Ser Ile Leu Glu Asn Leu
 355 360 365

Pro Val Val Ser Val Ser Leu Ser Glu His Gly His Thr Pro His Tyr
 370 375 380

Val Pro Met Glu Asp Pro Leu Val Gln Thr Leu Leu Asn Ile Tyr Glu
 385 390 395 400

Lys Gln Thr Gly Phe Lys Gly His Glu Gln Val Ile Gly Gly Gly Thr
 405 410 415

Phe Gly Arg Leu Leu Glu Arg Gly Val Ala Tyr Gly Ala Met Phe Pro
 420 425 430

Asp Ser Ile Asp Thr Met His Gln Ala Asn Glu Phe Ile Ala Leu Asp
 435 440 445

Asp Leu Phe Arg Ala Ala Ala Ile Tyr Ala Glu Ala Ile Tyr Glu Leu
 450 455 460

Ile Lys
 465

<210> 33

<211> 1617

<212> DNA

<213> Streptococcus pneumoniae

<400> 33

gtgtatacta ttataaaatc aaatataaaa aaatttagtt tattaacgat atttattggt 60
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 attgcatga atttagagcg gtttttgaaa ttgtcaatct accaaatgat tgtctggtgt 180
 gggataatat tccttgactg ggtagtga aaattatcagg ttgaagtgat ccaagagttt 240
 aatctagaga ttcgaaatag agttgccaca gacatctcta actctacct tcaagaattt 300
 catagtaaatt catcaggaac atatctttcg tggctaaata atgatgttca gactttaaat 360
 gatcaggcgt ttaaacaact ttttttagta ataaaaggaa tttctggtac tatatttgca 420
 gttgtgactc ttaatcacta tcattggtca ttgactgtag ccacctgtt ttcattaatg 480
 attatgctac ttgtaccaa aatctttgca tcgaaaatgc gagaagttag tctaaattta 540

actaaccaaa atgaagcttt tttaaaatct agtgagacta tattgaatgg atttgatgtg 600
 ttagcgctcct tgaatctttt atatgtattg cctaagaaaa ttaaagaagc aggaatttta 660
 ttaaagatgg ttatacaaag aaagacaact gtagaaacgt tagcaggcgc tattagcttc 720
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 gaacgtaaga tattagatag agaggatttg actgtcatta ttgttaccba tgctccgcac 1560
 ccggaactta aacaatattt tactaagata tatcaatttc caaaggattt tatttaa 1617

<210> 34

<211> 538

<212> PRT

<213> Streptococcus pneumoniae

<400> 34

Met Tyr Thr Ile Ile Lys Ser Asn Ile Lys Lys Phe Ser Leu Leu Thr

1

5

10

15

Ile Phe Ile Val Ala Gly Gln Leu Leu Leu Ile Tyr Ala Ala Thr Ile

20

25

30

Asn Ala Leu Val Leu Asn Glu Leu Ile Ala Met Asn Leu Glu Arg Phe

35

40

45

Leu Lys Leu Ser Ile Tyr Gln Met Ile Val Trp Cys Gly Ile Ile Phe

50

55

60

Leu Asp Trp Val Val Lys Asn Tyr Gln Val Glu Val Ile Gln Glu Phe
 65 70 75 80

Asn Leu Glu Ile Arg Asn Arg Val Ala Thr Asp Ile Ser Asn Ser Thr
 85 90 95

Tyr Gln Glu Phe His Ser Lys Ser Ser Gly Thr Tyr Leu Ser Trp Leu
 100 105 110

Asn Asn Asp Val Gln Thr Leu Asn Asp Gln Ala Phe Lys Gln Leu Phe
 115 120 125

Leu Val Ile Lys Gly Ile Ser Gly Thr Ile Phe Ala Val Val Thr Leu
 130 135 140

Asn His Tyr His Trp Ser Leu Thr Val Ala Thr Leu Phe Ser Leu Met
 145 150 155 160

Ile Met Leu Leu Val Pro Lys Ile Phe Ala Ser Lys Met Arg Glu Val
 165 170 175

Ser Leu Asn Leu Thr Asn Gln Asn Glu Ala Phe Leu Lys Ser Ser Glu
 180 185 190

Thr Ile Leu Asn Gly Phe Asp Val Leu Ala Ser Leu Asn Leu Leu Tyr
 195 200 205

Val Leu Pro Lys Lys Ile Lys Glu Ala Gly Ile Leu Leu Lys Met Val
 210 215 220

Ile Gln Arg Lys Thr Thr Val Glu Thr Leu Ala Gly Ala Ile Ser Phe
 225 230 235 240

Phe Leu Asn Ile Phe Phe Gln Ile Ser Leu Val Phe Leu Thr Gly Tyr
 245 250 255

Leu Ala Ile Lys Gly Ile Val Lys Ile Gly Thr Ile Glu Ala Ile Gly
 260 265 270

Gly Gln Lys Gln Lys Ile Thr Leu Ala Arg Gly Leu Ile Arg Asn Lys
465 470 475 480

Lys Ile Val Leu Ile Asp Glu Gly Thr Ser Ala Ile Asp Arg Arg Thr
 485 490 495

Ser Leu Ala Ile Glu Arg Lys Ile Leu Asp Arg Glu Asp Leu Thr Val
 500 505 510

Ile Ile Val Thr His Ala Pro His Pro Glu Leu Lys Gln Tyr Phe Thr
 515 520 525

Lys Ile Tyr Gln Phe Pro Lys Asp Phe Ile
 530 535

<210> 35

<211> 705

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 35

ataacagtta aacagattat ggacgaaata gccgtttcag atatgactgc aaggcgctat 60
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 cgaaccaact cccttttgac taatgagcga tcaaattattg aaaaacaagc cctccaaacg 180
 gcagaaaaac aagaaatagc ccattttgca ggcagtctag tagaagaaag agaaactatt 240
 ttcatgggac caggaacaac attagagttt tttgcgcgtg agttgcctat tgacaatatc 300
 cgcgtcgtaa ccaacagtct acctgttttt ctgattttta gcgaacgaaa attaacagat 360
 ttgattttta taggtggaaa ttatcgcgat attacagggtg cttttgttgg tacattgacc 420
 ctacaaaatc tctctaactc ccaattttct aaagctttcg ttagctgtaa tggatttcaa 480
 aacggagctc tagctacttt tagcgaggaa gagggagagg ctcaacgcat cgctttaaat 540
 aattctaata aaaaatattt actcgcatat catagcaagt tcaataagtt tgatttttat 600
 actttttata atgtatcaaa tcttgatact attgtttcag attctaaaact aagtgtattca 660
 atccttttta agctatctaa acacattaaa gtcacatcaagc cttaa 705

<210> 36

<211> 234

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 36

Ile Thr Val Lys Gln Ile Met Asp Glu Ile Ala Val Ser Asp Met Thr
 1 5 10 15

Ala Arg Arg Tyr Leu Gln Glu Leu Ala Asp Lys Asp Leu Leu Ile Arg
 20 25 30

Val His Gly Gly Ala Glu Lys Leu Arg Thr Asn Ser Leu Leu Thr Asn
 35 40 45

Glu Arg Ser Asn Ile Glu Lys Gln Ala Leu Gln Thr Ala Glu Lys Gln
 50 55 60

Glu Ile Ala His Phe Ala Gly Ser Leu Val Glu Glu Arg Glu Thr Ile
 65 70 75 80

Phe Ile Gly Pro Gly Thr Thr Leu Glu Phe Phe Ala Arg Glu Leu Pro
 85 90 95

Ile Asp Asn Ile Arg Val Val Thr Asn Ser Leu Pro Val Phe Leu Ile
 100 105 110

Leu Ser Glu Arg Lys Leu Thr Asp Leu Ile Leu Ile Gly Gly Asn Tyr
 115 120 125

Arg Asp Ile Thr Gly Ala Phe Val Gly Thr Leu Thr Leu Gln Asn Leu
 130 135 140

Ser Asn Leu Gln Phe Ser Lys Ala Phe Val Ser Cys Asn Gly Ile Gln
 145 150 155 160

Asn Gly Ala Leu Ala Thr Phe Ser Glu Glu Glu Gly Glu Ala Gln Arg
 165 170 175

Ile Ala Leu Asn Asn Ser Asn Lys Lys Tyr Leu Leu Ala Asp His Ser
 180 185 190

Lys Phe Asn Lys Phe Asp Phe Tyr Thr Phe Tyr Asn Val Ser Asn Leu
 195 200 205

Asp Thr Ile Val Ser Asp Ser Lys Leu Ser Asp Ser Ile Leu Phe Lys
 210 215 220

Leu Ser Lys His Ile Lys Val Ile Lys Pro
 225 230

<210> 37

<211> 483

<212> DNA

<213> Streptococcus pneumoniae

<400> 37

atgactgagt tttcgtaga tcttcttota gaagccatta aactagctcg ttggacctac 60
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 caatccatct ttatcgaaca caagggaaat tatgcttata gccgggttca tttagaacta 180
 agaaatcgtg gttatctggt aaatcataaa agagttcaag gcttgatgaa agtactcaat 240
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 aaggcagaga atctcattca agcccaattt gaaggctota aaacaatgga aaagtgtac 360
 acagatgtga ctgaatttgc cattccagca agtactcaaa agctttactt atcaccagtt 420
 ttagatggct ttaacagcga aattattgct tttaatcttt cttgttogcc taatttagaa 480
 taa 483

<210> 38

<211> 160

<212> PRT

<213> Streptococcus pneumoniae

<400> 38

Met Thr Glu Phe Ser Leu Asp Leu Leu Leu Glu Ala Ile Lys Leu Ala
 1 5 10 15

Arg Trp Thr Tyr Tyr Tyr His Leu Lys Gln Leu Asp Lys Thr Asp Lys
 20 25 30

Asp Gln Glu Leu Lys Thr Glu Ile Gln Ser Ile Phe Ile Glu His Lys
 35 40 45

Gly Asn Tyr Ala Tyr Arg Arg Val His Leu Glu Leu Arg Asn Arg Gly
 50 55 60

Tyr Leu Val Asn His Lys Arg Val Gln Gly Leu Met Lys Val Leu Asn
 65 70 75 80

Leu Gln Ala Lys Met Arg Lys Lys Arg Lys Tyr Ser Ser His Lys Gly
 85 90 95

Asp Val Gly Lys Lys Ala Glu Asn Leu Ile Gln Ala Gln Phe Glu Gly
 100 105 110

Ser Lys Thr Met Glu Lys Cys Tyr Thr Asp Val Thr Glu Phe Ala Ile
 115 120 125

Pro Ala Ser Thr Gln Lys Leu Tyr Leu Ser Pro Val Leu Asp Gly Phe
 130 135 140

Asn Ser Glu Ile Ile Ala Phe Asn Leu Ser Cys Ser Pro Asn Leu Glu
 145 150 155 160

<210> 39

<211> 1266

<212> DNA

<213> Streptococcus pneumoniae

<400> 39

ccaggatttg gtaccgttgc aagtgggtg cctttcctcc taaaggaaaa tggaggaaaa 60
 atcaatcaat cagcacattc agatatcaaa gttgctaagg tattggtcaa ggatgaagat 120
 gaaaaaaatc gcttgcttgc agcagggaat gactttaact ttgtaaccaa tgtggatgat 180

attttatcag accaggatat tactatcgta gtggaattga tggggcgat tgagcctgct 240
 aaaaccttta tcaactcggtc cttggaagct ggaaaacacg ttgttactgc taacaaggac 300
 ctttttagctg tccatggcgc agaattgcta gaaatcgctc aagctaacaa ggtagcactt 360
 tactacgaag cagcagttgc tgggtgggatt ccaattcttc gtacttttagc aaattccttg 420
 gcttctgata aaattacgcg cgtgcttgga gtagtcaacg gaacttccaa cttcatgggtg 480
 accaagatgg tggaagaagg ctgggtcttac gatgatgctc ttgcggaagc acaacgtcta 540
 ggattttgcag aaagcgatcc gacgaatgac gtagatggga ttgatgcagc ctacaagatg 600
 gttattttga gccaatgtgc ctttggcatg aagattgcct ttgatgatgt agcccacaag 660
 ggaatccgca atatcacacc agaagacgta gctgtagctc aagagcttgg ttacgtagtg 720
 aaattgggtg gttctattga ggaaacttct tcagggtattg ctgcagaagt gactccaacc 780
 ttcctaccta aagcgacccc acttgctagt gtgaatggcg taatgaacgc tgtctttgta 840
 gaatctatcg gtattgggtga gtctatgtac tacggaccag gtgcgggtca aaaaccaact 900
 gcaacaagtg ttgtagctga tattgtccgt atcgttcgtc gtttgaatga tggtagctatt 960
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 gacaaggcgc gtgtcggtat catcacacac aagattaata aagcccagct tgaaaatgtc 1200
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 gaataa 1266

<210> 40

<211> 421

<212> PRT

<213> Streptococcus pneumoniae

<400> 40

Pro Gly Phe Gly Thr Val Ala Ser Gly Val Pro Phe Leu Leu Lys Glu

1

5

10

15

Asn Gly Gly Lys Ile Asn Gln Ser Ala His Ser Asp Ile Lys Val Ala

20

25

30

Lys Val Leu Val Lys Asp Glu Asp Glu Lys Asn Arg Leu Leu Ala Ala

35

40

45

Gly Asn Asp Phe Asn Phe Val Thr Asn Val Asp Asp Ile Leu Ser Asp

50

55

60

Gln Asp Ile Thr Ile Val Val Glu Leu Met Gly Arg Ile Glu Pro Ala
65 70 75 80

Lys Thr Phe Ile Thr Arg Ala Leu Glu Ala Gly Lys His Val Val Thr
85 90 95

Ala Asn Lys Asp Leu Leu Ala Val His Gly Ala Glu Leu Leu Glu Ile
100 105 110

Ala Gln Ala Asn Lys Val Ala Leu Tyr Tyr Glu Ala Ala Val Ala Gly
115 120 125

Gly Ile Pro Ile Leu Arg Thr Leu Ala Asn Ser Leu Ala Ser Asp Lys
130 135 140

Ile Thr Arg Val Leu Gly Val Val Asn Gly Thr Ser Asn Phe Met Val
145 150 155 160

Thr Lys Met Val Glu Glu Gly Trp Ser Tyr Asp Asp Ala Leu Ala Glu
165 170 175

Ala Gln Arg Leu Gly Phe Ala Glu Ser Asp Pro Thr Asn Asp Val Asp
180 185 190

Gly Ile Asp Ala Ala Tyr Lys Met Val Ile Leu Ser Gln Phe Ala Phe
195 200 205

Gly Met Lys Ile Ala Phe Asp Asp Val Ala His Lys Gly Ile Arg Asn
210 215 220

Ile Thr Pro Glu Asp Val Ala Val Ala Gln Glu Leu Gly Tyr Val Val
225 230 235 240

Lys Leu Val Gly Ser Ile Glu Glu Thr Ser Ser Gly Ile Ala Ala Glu
245 250 255

Val Thr Pro Thr Phe Leu Pro Lys Ala His Pro Leu Ala Ser Val Asn
260 265 270

Gly Val Met Asn Ala Val Phe Val Glu Ser Ile Gly Ile Gly Glu Ser
 275 280 285

Met Tyr Tyr Gly Pro Gly Ala Gly Gln Lys Pro Thr Ala Thr Ser Val
 290 295 300

Val Ala Asp Ile Val Arg Ile Val Arg Arg Leu Asn Asp Gly Thr Ile
 305 310 315 320

Gly Lys Asp Phe Asn Glu Tyr Ser Arg Asp Leu Val Leu Ala Asn Pro
 325 330 335

Glu Asp Val Lys Ala Asn Tyr Tyr Phe Ser Ile Leu Ala Leu Asp Ser
 340 345 350

Lys Gly Gln Val Leu Lys Leu Ala Glu Ile Phe Asn Ala Gln Asp Ile
 355 360 365

Ser Phe Lys Gln Ile Leu Gln Asp Gly Lys Glu Gly Asp Lys Ala Arg
 370 375 380

Val Val Ile Ile Thr His Lys Ile Asn Lys Ala Gln Leu Glu Asn Val
 385 390 395 400

Ser Ala Glu Leu Lys Lys Val Ser Glu Phe Asp Leu Leu Asn Thr Phe
 405 410 415

Lys Val Leu Gly Glu
 420

<210> 41

<211> 1725

<212> DNA

<213> Streptococcus pneumoniae

<400> 41

atgaaacacc tattatctta cttcaaacc tacatcaagg aatcaatttt agcccccttg 60
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gaccaatcctt tacctcaggg agatcaaggt catctctgga tgcagattgg cctgctcctt 180
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 aaggacagca gagaccgtct gacaacttct agtttggtca ctgcttgac ttcggatacc 360
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 tacagtagtc tcagaaagaa aacggaccaa ctgggtcagg aaacgcgcca gcaattgcaa 600
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 agcttaattt tgatctctca acgaacctca actttacaga tggcggacca gattctctc 1620
 ttggaaaaag gtgagttgct agctgttggc aagcacgatg acttgatgaa atccagccaa 1680
 gtctattgtg aaatcaatgc atccaacat ggaaaggagg actag 1725

<210> 42

<211> 574

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 42

Met Lys His Leu Leu Ser Tyr Phe Lys Pro Tyr Ile Lys Glu Ser Ile

1

5

10

15

Gly Gln Glu Lys Arg Glu Leu Gln Ile Phe Gln Thr Leu Asn Gln Val
210 215 220

Tyr Ala Arg Leu Gln Glu Lys Thr Gly Phe Trp Ser Ser Leu Leu Thr
 225 230 235 240

Pro Leu Thr Tyr Leu Ile Val Asn Gly Thr Leu Leu Val Ile Ile Trp
 245 250 255

Gln Gly Tyr Ile Ser Ile Gln Gly Gly Val Leu Ser Gln Gly Ala Leu
 260 265 270

Ile Ala Leu Ile Asn Tyr Leu Leu Gln Ile Leu Val Glu Leu Val Lys
 275 280 285

Leu Ala Met Leu Ile Asn Ser Leu Asn Gln Ser Tyr Ile Ser Val Lys
 290 295 300

Arg Ile Glu Glu Val Phe Val Glu Ala Pro Glu Asp Ile His Ser Glu
 305 310 315 320

Leu Glu Gln Lys Gln Ala Thr Arg Asp Lys Val Leu Gln Val Gln Glu
 325 330 335

Leu Thr Phe Thr Tyr Pro Asp Ala Ala Gln Pro Ser Leu Arg Tyr Ile
 340 345 350

Ser Phe Asp Met Thr Gln Gly Gln Ile Leu Gly Ile Ile Gly Gly Thr
 355 360 365

Gly Ser Gly Lys Ser Ser Leu Val Gln Leu Leu Leu Gly Leu Tyr Pro
 370 375 380

Val Asp Lys Gly Asn Ile Asp Leu Tyr Gln Asn Gly Arg Ser Pro Leu
 385 390 395 400

Asn Leu Glu Gln Trp Arg Ser Trp Ile Ala Tyr Val Pro Gln Lys Val
 405 410 415

Glu Leu Phe Lys Gly Thr Ile Arg Ser Asn Leu Thr Leu Gly Phe Asn
 420 425 430

Gln Glu Val Ser Asp Gln Glu Leu Trp Gln Ala Leu Glu Ile Ala Gln
 435 440 445

Ala Lys Asp Phe Val Ser Glu Lys Glu Gly Leu Leu Asp Ala Leu Val
 450 455 460

Glu Ala Gly Gly Arg Asn Phe Ser Gly Gly Gln Lys Gln Arg Leu Ser
 465 470 475 480

Ile Ala Arg Ala Val Leu Arg Gln Ala Pro Phe Leu Ile Leu Asp Asp
 485 490 495

Ala Thr Ser Ala Leu Asp Thr Ile Thr Glu Ser Lys Leu Leu Lys Ala
 500 505 510

Ile Arg Glu Asn Phe Pro Asn Thr Ser Leu Ile Leu Ile Ser Gln Arg
 515 520 525

Thr Ser Thr Leu Gln Met Ala Asp Gln Ile Leu Leu Leu Glu Lys Gly
 530 535 540

Glu Leu Leu Ala Val Gly Lys His Asp Asp Leu Met Lys Ser Ser Gln
 545 550 555 560

Val Tyr Cys Glu Ile Asn Ala Ser Gln His Gly Lys Glu Asp
 565 570

<210> 43

<211> 1224

<212> DNA

<213> Streptococcus pneumoniae

<400> 43

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 ctgcccattt tagggcagca ggtcgccctgg attgccttgg ggcttgtgat tggttttgtg 180

gtcattgctct ttaatacaga atttctttgg aaggtagccc cctttctata tatttttaggc 240
 ttgggactta tgatcttgcc gattgtatct tataatccaa gcttagttgc atcaacgggt 300
 gccaaaaact ggggtatcaat aaatggaatt accctattcc aaccgtcaga atttatgaag 360
 atatactata tcctcatggt ggctcgtgct attgtccaat ttacaaagaa acataaggaa 420
 tggagacgca cgggtccgct ggactttttg ttaattttct ggatgattct ctttaccatt 480
 ccagtcctag ttcttttagc acttcaaagt gacttgggga cggctttggt tttttagacc 540
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 gtgactgctg taacaggagt tgctgggttc ttagctatct ttattagcaa ggacggacga 660
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 aatccctttg agtttgccca aacaacgact taccagcagg ctcaagggca gattgccatt 780
 gggagtgggtg gcttatttgg tcagggattt aatgcttcga atctgcttat ccagttcga 840
 gagtcagata tgatttttac ggttattgca gaagattttg gctttattgg ctctgtcctg 900
 gttattgccc tctatctcat gttgatttac cgtatgttga agattactct taaatcaaatt 960
 aaccagttct acacttatat ttccacagggt ttgattatga tgttgctctt ccacatcttt 1020
 gagaatatcg gtgctgtgac tggactactt cctttgacgg ggattccctt gcctttcatt 1080
 tcgcaagggg gatcagctat tatcagtaat ctgattggtg ttggtttgct tttatcgatg 1140
 agttaccaga ctaatctagc tgaagaaaag agcggaaaag tcccattcaa acggaaaaag 1200
 gttgtattaa aacaaattaa ataa 1224

<210> 44

<211> 407

<212> PRT

<213> Streptococcus pneumoniae

<400> 44

Met Lys Arg Ser Leu Asp Ser Arg Val Asp Tyr Ser Leu Leu Leu Pro

1

5

10

15

Val Phe Phe Leu Leu Val Ile Gly Val Val Ala Ile Tyr Ile Ala Val

20

25

30

Ser His Asp Tyr Pro Asn Asn Ile Leu Pro Ile Leu Gly Gln Gln Val

35

40

45

Ala Trp Ile Ala Leu Gly Leu Val Ile Gly Phe Val Val Met Leu Phe

50

55

60

Asn Thr Glu Phe Leu Trp Lys Val Thr Pro Phe Leu Tyr Ile Leu Gly
 65 70 75 80

Leu Gly Leu Met Ile Leu Pro Ile Val Phe Tyr Asn Pro Ser Leu Val
 85 90 95

Ala Ser Thr Gly Ala Lys Asn Trp Val Ser Ile Asn Gly Ile Thr Leu
 100 105 110

Phe Gln Pro Ser Glu Phe Met Lys Ile Ser Tyr Ile Leu Met Leu Ala
 115 120 125

Arg Val Ile Val Gln Phe Thr Lys Lys His Lys Glu Trp Arg Arg Thr
 130 135 140

Val Pro Leu Asp Phe Leu Leu Ile Phe Trp Met Ile Leu Phe Thr Ile
 145 150 155 160

Pro Val Leu Val Leu Leu Ala Leu Gln Ser Asp Leu Gly Thr Ala Leu
 165 170 175

Val Phe Val Ala Ile Phe Ser Gly Ile Val Leu Leu Ser Gly Val Ser
 180 185 190

Trp Lys Ile Ile Ile Pro Val Phe Val Thr Ala Val Thr Gly Val Ala
 195 200 205

Gly Phe Leu Ala Ile Phe Ile Ser Lys Asp Gly Arg Ala Phe Leu His
 210 215 220

Gln Ile Gly Met Pro Thr Tyr Gln Ile Asn Arg Ile Leu Ala Trp Leu
 225 230 235 240

Asn Pro Phe Glu Phe Ala Gln Thr Thr Thr Tyr Gln Gln Ala Gln Gly
 245 250 255

Gln Ile Ala Ile Gly Ser Gly Gly Leu Phe Gly Gln Gly Phe Asn Ala
 260 265 270

Ser Asn Leu Leu Ile Pro Val Arg Glu Ser Asp Met Ile Phe Thr Val
 275 280 285

Ile Ala Glu Asp Phe Gly Phe Ile Gly Ser Val Leu Val Ile Ala Leu
 290 295 300

Tyr Leu Met Leu Ile Tyr Arg Met Leu Lys Ile Thr Leu Lys Ser Asn
 305 310 315 320

Asn Gln Phe Tyr Thr Tyr Ile Ser Thr Gly Leu Ile Met Met Leu Leu
 325 330 335

Phe His Ile Phe Glu Asn Ile Gly Ala Val Thr Gly Leu Leu Pro Leu
 340 345 350

Thr Gly Ile Pro Leu Pro Phe Ile Ser Gln Gly Gly Ser Ala Ile Ile
 355 360 365

Ser Asn Leu Ile Gly Val Gly Leu Leu Leu Ser Met Ser Tyr Gln Thr
 370 375 380

Asn Leu Ala Glu Glu Lys Ser Gly Lys Val Pro Phe Lys Arg Lys Lys
 385 390 395 400

Val Val Leu Lys Gln Ile Lys
 405

<210> 45

<211> 1104

<212> DNA

<213> Streptococcus pneumoniae

<400> 45

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 cttgaaatgg agcactttga caagggatat gaatctgttc caaagcatgt acgcatttta 180

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aaatcccttc aagattatcg ccaaaccaga tggttacgag cttttttgtg gagaatgaga 240
atattattttc caagactgac tcgtcgtttg cttgtaaaag atgattatga tgttgaagtt 300
tctttttacca ttatgaatcc accactgttg ttctctaaaa gaagagaagt caagaagata 360
tcttggattc atggaagtat tgaagaactt ctttaaggata gctctaaaag agaatcacat 420
agaagccagt tggatgctgc gaatacaatt gtagggattt caaaaaagac cagcaattct 480
atcaaggaag tttatccaga ttatacttct aaattacaga caatctacaa tggatatgat 540
tttcagacta ttctagaaaa atctcaagag aagatcgata tcgagattgc tcctcaaagt 600
atctgtacta tcggacggat tgaggaaaat aagggttctg accgtgtagt ggaagtgata 660
cgattattac accaagaggg aaaaaactat catctctatt ttatcggggc tggtgatatg 720
gaagaggaac tgaaaaaacg agtcaaagag tatgggattg aggactatgt acatttcctt 780
ggttatcaaa aaaatcctta tcagtatcta tctcagacga aagttctttt gtctatgtct 840
aaacaagaag gttttcctgg agtgtatgtg gaggccttga gtctgggact cccttttato 900
tctacggacg ttggaggggc tgaggaatta tcccaagaag gacgatttgg acaaatcatt 960
gagagcaatc aagaggcagc tcaggcgatt actaattaca tgacttctgc ctcaaacttt 1020
gatgtcgatg aggctagcca attcattcaa caatttacia ttacaaaaca aatcgaacaa 1080
gtagaaaaac tattagagga gtag                                     1104

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<210> 46

<211> 367

<212> PRT

<213> Streptococcus pneumoniae

<400> 46

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Met Val Ala Lys Lys Lys Ile Leu Phe Phe Met Trp Ser Phe Ser Leu
  1              5              10              15

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Gly Gly Gly Ala Glu Lys Ile Leu Ser Thr Ile Val Ser Asn Leu Asp
      20              25              30

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Pro Glu Lys Tyr Asp Ile Asp Ile Leu Glu Met Glu His Phe Asp Lys
      35              40              45

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Gly Tyr Glu Ser Val Pro Lys His Val Arg Ile Leu Lys Ser Leu Gln
      50              55              60

```

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Asp Tyr Arg Gln Thr Arg Trp Leu Arg Ala Phe Leu Trp Arg Met Arg
      65              70              75              80

```

Ile Tyr Phe Pro Arg Leu Thr Arg Arg Leu Leu Val Lys Asp Asp Tyr
 85 90 95

Asp Val Glu Val Ser Phe Thr Ile Met Asn Pro Pro Leu Leu Phe Ser
 100 105 110

Lys Arg Arg Glu Val Lys Lys Ile Ser Trp Ile His Gly Ser Ile Glu
 115 120 125

Glu Leu Leu Lys Asp Ser Ser Lys Arg Glu Ser His Arg Ser Gln Leu
 130 135 140

Asp Ala Ala Asn Thr Ile Val Gly Ile Ser Lys Lys Thr Ser Asn Ser
 145 150 155 160

Ile Lys Glu Val Tyr Pro Asp Tyr Thr Ser Lys Leu Gln Thr Ile Tyr
 165 170 175

Asn Gly Tyr Asp Phe Gln Thr Ile Leu Glu Lys Ser Gln Glu Lys Ile
 180 185 190

Asp Ile Glu Ile Ala Pro Gln Ser Ile Cys Thr Ile Gly Arg Ile Glu
 195 200 205

Glu Asn Lys Gly Ser Asp Arg Val Val Glu Val Ile Arg Leu Leu His
 210 215 220

Gln Glu Gly Lys Asn Tyr His Leu Tyr Phe Ile Gly Ala Gly Asp Met
 225 230 235 240

Glu Glu Glu Leu Lys Lys Arg Val Lys Glu Tyr Gly Ile Glu Asp Tyr
 245 250 255

Val His Phe Leu Gly Tyr Gln Lys Asn Pro Tyr Gln Tyr Leu Ser Gln
 260 265 270

Thr Lys Val Leu Leu Ser Met Ser Lys Gln Glu Gly Phe Pro Gly Val
 275 280 285

Tyr Val Glu Ala Leu Ser Leu Gly Leu Pro Phe Ile Ser Thr Asp Val
 290 295 300

Gly Gly Ala Glu Glu Leu Ser Gln Glu Gly Arg Phe Gly Gln Ile Ile
 305 310 315 320

Glu Ser Asn Gln Glu Ala Ala Gln Ala Ile Thr Asn Tyr Met Thr Ser
 325 330 335

Ala Ser Asn Phe Asp Val Asp Glu Ala Ser Gln Phe Ile Gln Gln Phe
 340 345 350

Thr Ile Thr Lys Gln Ile Glu Gln Val Glu Lys Leu Leu Glu Glu
 355 360 365

<210> 47

<211> 987

<212> DNA

<213> Streptococcus pneumoniae

<400> 47

atggaaactg cattaattag tgtgattgtg ccagtctata atgtggcgca gtacctagaa 60
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 gatggtgcaa cagatgaaag tggctcgcttg tgtgattcaa tcgctgaaca agatgacagg 180
 gtgtcagtg cttcataaaaa gaacgaagga ttgtcgcaag cacgaaatga tgggatgaag 240
 caggctcacg gggattatct gattttttatt gactcagatg attatatcca tccagaaatg 300
 attcagagct tatatgagca attagttcaa gaagatgcgg atgttttcgag ctgtggtgtc 360
 atgaatgtct atgctaata gaagagccca cagtcagcca atcaggatga ctattttgtc 420
 tgtgattctc aaacattttc aaaggaatac ctcataggtg aaaaaatacc tgggacgatt 480
 tgcaataagc taatcaagag acagattgca actgcctat cctttcctaa ggggttgatt 540
 tacgaagatg cctattacca ttttgattta atcaagttgg ccaagaagta tgtggttaat 600
 actaaaccct attattacta tttccataga ggggatagta ttacgaccaa accctatgca 660
 gagaaggatt tagcctatat tgatatctac caaagttttt ataatagaagt tgtgaaaaac 720
 tatcctgact tgaaagaggt cgcttttttc agattggcct atgcccactt ctttattctg 780
 gataagatgt tgctagatga tcagtataaa cagtttgaag cctattctca gattcatcgt 840
 tttttaaaag gccatgcctt tgctattttc aggaatccaa ttttccgtaa ggggagaaga 900

attagtgcctt tggccctatt cataaatatt tccttatatc gattccttatt actgaaaaat 960
 attgaaaaat ctaaaaaatt acattag 987

<210> 48

<211> 328

<212> PRT

<213> Streptococcus pneumoniae

<400> 48

Met Glu Thr Ala Leu Ile Ser Val Ile Val Pro Val Tyr Asn Val Ala
 1 5 10 15

Gln Tyr Leu Glu Lys Ser Ile Ala Ser Ile Gln Lys Gln Thr Tyr Gln
 20 25 30

Asn Leu Glu Ile Ile Leu Val Asp Asp Gly Ala Thr Asp Glu Ser Gly
 35 40 45

Arg Leu Cys Asp Ser Ile Ala Glu Gln Asp Asp Arg Val Ser Val Leu
 50 55 60

His Lys Lys Asn Glu Gly Leu Ser Gln Ala Arg Asn Asp Gly Met Lys
 65 70 75 80

Gln Ala His Gly Asp Tyr Leu Ile Phe Ile Asp Ser Asp Asp Tyr Ile
 85 90 95

His Pro Glu Met Ile Gln Ser Leu Tyr Glu Gln Leu Val Gln Glu Asp
 100 105 110

Ala Asp Val Ser Ser Cys Gly Val Met Asn Val Tyr Ala Asn Asp Glu
 115 120 125

Ser Pro Gln Ser Ala Asn Gln Asp Asp Tyr Phe Val Cys Asp Ser Gln
 130 135 140

Thr Phe Leu Lys Glu Tyr Leu Ile Gly Glu Lys Ile Pro Gly Thr Ile
 145 150 155 160

Cys Asn Lys Leu Ile Lys Arg Gln Ile Ala Thr Ala Leu Ser Phe Pro
 165 170 175

Lys Gly Leu Ile Tyr Glu Asp Ala Tyr Tyr His Phe Asp Leu Ile Lys
 180 185 190

Leu Ala Lys Lys Tyr Val Val Asn Thr Lys Pro Tyr Tyr Tyr Tyr Phe
 195 200 205

His Arg Gly Asp Ser Ile Thr Thr Lys Pro Tyr Ala Glu Lys Asp Leu
 210 215 220

Ala Tyr Ile Asp Ile Tyr Gln Lys Phe Tyr Asn Glu Val Val Lys Asn
 225 230 235 240

Tyr Pro Asp Leu Lys Glu Val Ala Phe Phe Arg Leu Ala Tyr Ala His
 245 250 255

Phe Phe Ile Leu Asp Lys Met Leu Leu Asp Asp Gln Tyr Lys Gln Phe
 260 265 270

Glu Ala Tyr Ser Gln Ile His Arg Phe Leu Lys Gly His Ala Phe Ala
 275 280 285

Ile Ser Arg Asn Pro Ile Phe Arg Lys Gly Arg Arg Ile Ser Ala Leu
 290 295 300

Ala Leu Phe Ile Asn Ile Ser Leu Tyr Arg Phe Leu Leu Leu Lys Asn
 305 310 315 320

Ile Glu Lys Ser Lys Lys Leu His
 325

<210> 49

<211> 735

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 49

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tatggtcatt caatcattct caaagatata aattttgcac ttaacaaggg tgaaattggt 120
gggtctagcag ggagaaatgg agttggtaag agtacgttga tgaaaattct tgttcagaat 180
aatcaaccga cttcaggtaa tattataagc agtgataatg ttgggtattht aatcgaagaa 240
ccaaaattat ttttatctaa aacagggtta gagaatttaa aatatttgtc aaattttatat 300
gggtgttgact acaatcaaga aagattttaga tgtttgatcc aagagtttaga tttgactcag 360
tctattaata aaaaagtaaa gacctattct ttgggtacaa aacaaaaatt agctttgctt 420
ctaactctcg ttacggaacc tgatatattg atttttagatg aaccgactaa tggtttagat 480
attgaatcat cacaaatagt ttttagcgggt ctaaaaaaat tagctttaca tgaaaatgtg 540
ggaattttta tatcgagtca taaattagaa gacattgaag aaatttgtga gagagtctct 600
ttcttgagaa acgggctttt gacatttcaa aaagtaggaa aagatagtca taatttcttg 660
tttgagatag ctttttcatc agctacagat agagacattt tcattaccaa acaagaattt 720
tgggatattg tttag                                     735

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<210> 50

<211> 244

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 50

Met Arg Ile Lys Glu Lys Thr Asn Asn Ile Asn Gly Gly Ile Lys Asn

1

5

10

15

Val Ser Lys His Tyr Gly His Ser Ile Ile Leu Lys Asp Ile Asn Phe

20

25

30

Ala Leu Asn Lys Gly Glu Ile Val Gly Leu Ala Gly Arg Asn Gly Val

35

40

45

Gly Lys Ser Thr Leu Met Lys Ile Leu Val Gln Asn Asn Gln Pro Thr

50

55

60

Ser Gly Asn Ile Ile Ser Ser Asp Asn Val Gly Tyr Leu Ile Glu Glu
65 70 75 80

Pro Lys Leu Phe Leu Ser Lys Thr Gly Leu Glu Asn Leu Lys Tyr Leu
85 90 95

Ser Asn Leu Tyr Gly Val Asp Tyr Asn Gln Glu Arg Phe Arg Cys Leu
100 105 110

Ile Gln Glu Leu Asp Leu Thr Gln Ser Ile Asn Lys Lys Val Lys Thr
115 120 125

Tyr Ser Leu Gly Thr Lys Gln Lys Leu Ala Leu Leu Leu Thr Leu Val
130 135 140

Thr Glu Pro Asp Ile Leu Ile Leu Asp Glu Pro Thr Asn Gly Leu Asp
145 150 155 160

Ile Glu Ser Ser Gln Ile Val Leu Ala Val Leu Lys Lys Leu Ala Leu
165 170 175

His Glu Asn Val Gly Ile Leu Ile Ser Ser His Lys Leu Glu Asp Ile
180 185 190

Glu Glu Ile Cys Glu Arg Val Leu Phe Leu Glu Asn Gly Leu Leu Thr
195 200 205

Phe Gln Lys Val Gly Lys Asp Ser His Asn Phe Leu Phe Glu Ile Ala
210 215 220

Phe Ser Ser Ala Thr Asp Arg Asp Ile Phe Ile Thr Lys Gln Glu Phe
225 230 235 240

Trp Asp Ile Val

<210> 51

<211> 1704

<212> DNA

<213> Streptococcus pneumoniae

<400> 51

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ggagtgattt cgacttgggc ggaaaataca ccatgtaaca ttcacttgca tgatttcggg 180
aaactggcta aagaagggtg caaatctgca ggcgcttggc ctgtacagtt tggaaaccatt 240
accgtagcgg acgggatcgc tatgggaacg cctggatatgc gtttctctct aacatctcgt 300
gacatcatcg cggactccat cgaggcggct atgagtggtc acaacgtgga tgccttcgtc 360
gctatcggtg gctgtgacaa gaacatgcct ggatctatga ttgctattgc taatatggat 420
atcccagcta ttttcgccta tgggtggaact attgcaccgg gaaatcttga tggtaaagat 480
atcgacttgg tttctgtctt tgaaggtatc ggaaaatgga accacggtga catgacagct 540
gaggacgtga aacgtcttga atgtaatgcc tgccctggcc ctggtggttg tggtggtatg 600
tatactgcta ataccatggc aactgctatc gaagttctag ggatgagttt gccagggtca 660
tcctctcacc cagctgaatc agctgataag aaagaagata tcgaagcagc aggacgtgct 720
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ttgactccag gccaaaaagt tatcatgcca cttgaaaatc caaaacgtgc ggatgggtccg 1140
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aaagtgcgtc gtcacgttgg gccagctaag gtctttgact cagaagaaga tgcgattcag 1260
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ggcgatatcg ttacggttga ccaagatacc aaagaaatct ctatggccgt atccgaagaa 1560
gaacttgaaa aacgcaaggc agaaacaacc ttgccaccac tttacagccg tgggtgtcctc 1620
ggtaaatatg ccacatcgt atcatctgct tcacgcggag ccgtgacaga cttctggaat 1680
atggacaagt caggtaaaaa ataa 1704

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<210> 52

<211> 567

<212> PRT

<213> Streptococcus pneumoniae

<400> 52

Met Thr Glu Leu Asp Lys Arg His Arg Ser Ser Ile Tyr Asp Ser Met
 1 5 10 15

Val Lys Ser Pro Asn Arg Ala Met Leu Arg Ala Thr Gly Met Thr Asp
 20 25 30

Lys Asp Phe Glu Thr Ser Ile Val Gly Val Ile Ser Thr Trp Ala Glu
 35 40 45

Asn Thr Pro Cys Asn Ile His Leu His Asp Phe Gly Lys Leu Ala Lys
 50 55 60

Glu Gly Val Lys Ser Ala Gly Ala Trp Pro Val Gln Phe Gly Thr Ile
 65 70 75 80

Thr Val Ala Asp Gly Ile Ala Met Gly Thr Pro Gly Met Arg Phe Ser
 85 90 95

Leu Thr Ser Arg Asp Ile Ile Ala Asp Ser Ile Glu Ala Ala Met Ser
 100 105 110

Gly His Asn Val Asp Ala Phe Val Ala Ile Gly Gly Cys Asp Lys Asn
 115 120 125

Met Pro Gly Ser Met Ile Ala Ile Ala Asn Met Asp Ile Pro Ala Ile
 130 135 140

Phe Ala Tyr Gly Gly Thr Ile Ala Pro Gly Asn Leu Asp Gly Lys Asp
 145 150 155 160

Ile Asp Leu Val Ser Val Phe Glu Gly Ile Gly Lys Trp Asn His Gly
 165 170 175

Asp Met Thr Ala Glu Asp Val Lys Arg Leu Glu Cys Asn Ala Cys Pro
 180 185 190

Gly Pro Gly Gly Cys Gly Gly Met Tyr Thr Ala Asn Thr Met Ala Thr
 195 200 205

Ala Ile Glu Val Leu Gly Met Ser Leu Pro Gly Ser Ser Ser His Pro
 210 215 220

Ala Glu Ser Ala Asp Lys Lys Glu Asp Ile Glu Ala Ala Gly Arg Ala
 225 230 235 240

Val Val Lys Met Leu Glu Leu Gly Leu Lys Pro Ser Asp Ile Leu Thr
 245 250 255

Arg Glu Ala Phe Glu Asp Ala Ile Thr Val Thr Met Ala Leu Gly Gly
 260 265 270

Ser Thr Asn Ala Thr Leu His Leu Leu Ala Ile Ala His Ala Ala Asn
 275 280 285

Val Asp Leu Ser Leu Glu Asp Phe Asn Thr Ile Gln Glu Arg Val Pro
 290 295 300

His Leu Ala Asp Leu Lys Pro Ser Gly Gln Tyr Val Phe Gln Asp Leu
 305 310 315 320

Tyr Glu Val Gly Gly Val Pro Ala Val Met Lys Tyr Leu Leu Ala Asn
 325 330 335

Gly Phe Leu His Gly Asp Arg Ile Thr Cys Thr Gly Lys Thr Val Ala
 340 345 350

Glu Asn Leu Ala Asp Phe Ala Asp Leu Thr Pro Gly Gln Lys Val Ile
 355 360 365

Met Pro Leu Glu Asn Pro Lys Arg Ala Asp Gly Pro Leu Ile Ile Leu
 370 375 380

Asn Gly Asn Leu Ala Pro Asp Gly Ala Val Ala Lys Val Ser Gly Val
385 390 395 400

Lys Val Arg Arg His Val Gly Pro Ala Lys Val Phe Asp Ser Glu Glu
405 410 415

Asp Ala Ile Gln Ala Val Leu Thr Asp Glu Ile Val Asp Gly Asp Val
420 425 430

Val Val Val Arg Phe Val Gly Pro Lys Gly Gly Pro Gly Met Pro Glu
435 440 445

Met Leu Ser Leu Ser Ser Met Ile Val Gly Lys Gly Gln Gly Asp Lys
450 455 460

Val Ala Leu Leu Thr Asp Gly Arg Phe Ser Gly Gly Thr Tyr Gly Leu
465 470 475 480

Val Val Gly His Ile Ala Pro Glu Ala Gln Asp Gly Gly Pro Ile Ala
485 490 495

Tyr Leu Arg Thr Gly Asp Ile Val Thr Val Asp Gln Asp Thr Lys Glu
500 505 510

Ile Ser Met Ala Val Ser Glu Glu Glu Leu Glu Lys Arg Lys Ala Glu
515 520 525

Thr Thr Leu Pro Pro Leu Tyr Ser Arg Gly Val Leu Gly Lys Tyr Ala
530 535 540

His Ile Val Ser Ser Ala Ser Arg Gly Ala Val Thr Asp Phe Trp Asn
545 550 555 560

Met Asp Lys Ser Gly Lys Lys
565

<210> 53

<211> 274

<212> DNA

<213> Streptococcus pneumoniae

<400> 53

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atgttataat aaaaataaag aatttaagga gaaatacaat atgtcaattt ttattggagg 60
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ggatattcctt gcaagatact atcgtcagaa gggagaggaa gttttatatg tttctggaag 180
tgattgtaat ggaaccccta tttctatcag agctaaaaaa gaaaataagt ctgtgaaaga 240
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<210> 54

<211> 91

<212> PRT

<213> Streptococcus pneumoniae

<400> 54

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Cys Tyr Asn Lys Asn Lys Glu Phe Lys Glu Lys Tyr Asn Met Ser Ile
  1              5              10              15

Phe Ile Gly Gly Ala Trp Pro Tyr Ala Asn Gly Ser Leu His Ile Gly
      20              25              30

His Ala Ala Ala Leu Leu Pro Gly Asp Ile Leu Ala Arg Tyr Tyr Arg
      35              40              45

Gln Lys Gly Glu Glu Val Leu Tyr Val Ser Gly Ser Asp Cys Asn Gly
      50              55              60

Thr Pro Ile Ser Ile Arg Ala Lys Lys Glu Asn Lys Ser Val Lys Glu
      65              70              75              80

Ile Ala Asp Phe Tyr His Lys Glu Phe Asn Pro
      85              90

```

<210> 55

<211> 1065

<212> DNA

<213> Streptococcus pneumoniae

<400> 55

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acagatgggt tgggtgggtat ttttgggtatc aaacattcag aagctgtgga tgcaccgcgc 180
gtcttggtcg cttctcatat ggacgaagtt ggttttatgg tcagcgaaat caagccagat 240
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ttcaaaactct tgactcgtga tggatcatgaa attcctgtga tttcagggttc tgttcctccg 360
catttgactc gtggaaaggg gggaccaacc atgccagcca ttgccgatat cgtttttgat 420
ggtgggtttt cggacaaggc tgaggcagaa agttttggca tccgtcctgg tgataccatt 480
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ctcggcaatg aactctatct gggttctaac gtccaagaag aagttggtct gcgtggcgct 660
catacctcta caaccaagtt tgaccagaa gtcttcctcg cagttgattg ctcaccagca 720
ggtgatgtct acgggtgtca aggcaagatt ggagatggaa ccttgattcg tttctatgat 780
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aaaaatgggt gtgtcccatc aacaactatc ggtgtctgct ctcgttatat ccattctcac 960
caaaccctct atgcaatgga tgacttcta gaagcgcaag ctttcttaca agccttggtg 1020
aagaaattgg atcgttcaac ggttgatttg attaaacatt attaa 1065

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<210> 56

<211> 354

<212> PRT

<213> Streptococcus pneumoniae

<400> 56

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Met Thr Thr Leu Phe Ser Lys Ile Lys Glu Val Thr Glu Leu Ala Ala
  1              5              10              15

Val Ser Gly His Glu Ala Pro Val Arg Ala Tyr Leu Arg Glu Lys Leu
 20              25              30

```

Thr Pro His Val Asp Glu Val Val Thr Asp Gly Leu Gly Gly Ile Phe
 35 40 45

Gly Ile Lys His Ser Glu Ala Val Asp Ala Pro Arg Val Leu Val Ala
 50 55 60

Ser His Met Asp Glu Val Gly Phe Met Val Ser Glu Ile Lys Pro Asp
 65 70 75 80

Gly Thr Phe Arg Val Val Glu Ile Gly Gly Trp Asn Pro Met Val Val
 85 90 95

Ser Ser Gln Arg Phe Lys Leu Leu Thr Arg Asp Gly His Glu Ile Pro
 100 105 110

Val Ile Ser Gly Ser Val Pro Pro His Leu Thr Arg Gly Lys Gly Gly
 115 120 125

Pro Thr Met Pro Ala Ile Ala Asp Ile Val Phe Asp Gly Gly Phe Ala
 130 135 140

Asp Lys Ala Glu Ala Glu Ser Phe Gly Ile Arg Pro Gly Asp Thr Ile
 145 150 155 160

Val Pro Asp Ser Ser Ala Ile Leu Thr Ala Asn Glu Lys Asn Ile Ile
 165 170 175

Ser Lys Ala Trp Asp Asn Arg Tyr Gly Val Leu Met Val Ser Glu Leu
 180 185 190

Ala Glu Ala Leu Ser Gly Gln Lys Leu Gly Asn Glu Leu Tyr Leu Gly
 195 200 205

Ser Asn Val Gln Glu Glu Val Gly Leu Arg Gly Ala His Thr Ser Thr
 210 215 220

Thr Lys Phe Asp Pro Glu Val Phe Leu Ala Val Asp Cys Ser Pro Ala
 225 230 235 240

Gly Asp Val Tyr Gly Gly Gln Gly Lys Ile Gly Asp Gly Thr Leu Ile
 245 250 255

Arg Phe Tyr Asp Pro Gly His Leu Leu Leu Pro Gly Met Lys Asp Phe
 260 265 270

Leu Leu Thr Thr Ala Glu Glu Ala Gly Ile Lys Tyr Gln Tyr Tyr Cys
 275 280 285

Gly Lys Gly Gly Thr Asp Ala Gly Ala Ala His Leu Lys Asn Gly Gly
 290 295 300

Val Pro Ser Thr Thr Ile Gly Val Cys Ala Arg Tyr Ile His Ser His
 305 310 315 320

Gln Thr Leu Tyr Ala Met Asp Asp Phe Leu Glu Ala Gln Ala Phe Leu
 325 330 335

Gln Ala Leu Val Lys Lys Leu Asp Arg Ser Thr Val Asp Leu Ile Lys
 340 345 350

His Tyr

<210> 57

<211> 1182

<212> DNA

<213> Streptococcus pneumoniae

<400> 57

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 agcctatctc tgacttttat cctagccact cgtctccac tactagaaag ctggtttcac 180
 agtttggaga aggtctacac cgtccacaaa ttcacagcct ttctctcaat catcctacta 240
 atctttcata acttttagtat gggcggtttg tggggctctc gcttagctgc tcagtttggc 300
 aatcttgcca tctatatctt tgccagcatc atccttgctg cctatttagg caaatacatc 360

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caatacgaag cttggcgatg gattcaccgc ctggtttacc tagcctatat tttaggactc 420
tttcacatct acatgataat gggcaatcgt ctcccttacat ttaatcttct aagttttctt 480
gttggttagct atgccctttt aggcttacta gctgggtttt atatcatttt tctatatcaa 540
aagatttctt tcccctatct agggaaaatt acccatctca aacgcttaaa tcacgatact 600
agagaaattc aaatccatct tagcagacct ttcaactatc aatcaggaca atttgccctt 660
ctaaagattt tccaagaagg ctttgaaagt gctccgcac ccttttctat ctcaggaggt 720
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<210> 58

<211> 394

<212> PRT

<213> Streptococcus pneumoniae

<400> 58

Met Glu Phe Ser Met Lys Ser Val Lys Gly Leu Leu Phe Ile Ile Ala

1

5

10

15

Ser Phe Ile Leu Thr Leu Leu Thr Trp Met Asn Thr Ser Pro Gln Phe

20

25

30

Met Ile Pro Gly Leu Ala Leu Thr Ser Leu Ser Leu Thr Phe Ile Leu

35

40

45

Ala Thr Arg Leu Pro Leu Leu Glu Ser Trp Phe His Ser Leu Glu Lys

50

55

60

Val Tyr Thr Val His Lys Phe Thr Ala Phe Leu Ser Ile Ile Leu Leu

65

70

75

80

Ile Phe His Asn Phe Ser Met Gly Gly Leu Trp Gly Ser Arg Leu Ala
85 90 95

Ala Gln Phe Gly Asn Leu Ala Ile Tyr Ile Phe Ala Ser Ile Ile Leu
100 105 110

Val Ala Tyr Leu Gly Lys Tyr Ile Gln Tyr Glu Ala Trp Arg Trp Ile
115 120 125

His Arg Leu Val Tyr Leu Ala Tyr Ile Leu Gly Leu Phe His Ile Tyr
130 135 140

Met Ile Met Gly Asn Arg Leu Leu Thr Phe Asn Leu Leu Ser Phe Leu
145 150 155 160

Val Gly Ser Tyr Ala Leu Leu Gly Leu Leu Ala Gly Phe Tyr Ile Ile
165 170 175

Phe Leu Tyr Gln Lys Ile Ser Phe Pro Tyr Leu Gly Lys Ile Thr His
180 185 190

Leu Lys Arg Leu Asn His Asp Thr Arg Glu Ile Gln Ile His Leu Ser
195 200 205

Arg Pro Phe Asn Tyr Gln Ser Gly Gln Phe Ala Phe Leu Lys Ile Phe
210 215 220

Gln Glu Gly Phe Glu Ser Ala Pro His Pro Phe Ser Ile Ser Gly Gly
225 230 235 240

His Gly Gln Thr Leu Tyr Phe Thr Val Lys Thr Ser Gly Asp His Thr
245 250 255

Lys Asn Ile Tyr Asp Asn Leu Gln Ala Gly Ser Lys Val Thr Leu Asp
260 265 270

Arg Ala Tyr Gly His Met Ile Ile Glu Glu Gly Arg Glu Asn Gln Val
275 280 285

Trp Ile Ala Gly Gly Ile Gly Ile Thr Pro Phe Ile Ser Tyr Ile Arg
 290 295 300

Glu His Pro Ile Leu Asp Lys Gln Val His Phe Tyr Tyr Ser Phe Arg
 305 310 315 320

Gly Asp Glu Asn Ala Val Tyr Leu Asp Leu Leu Arg Asn Tyr Ala Gln
 325 330 335

Lys Asn Pro Asn Phe Glu Leu His Leu Ile Asp Ser Thr Lys Asp Gly
 340 345 350

Tyr Leu Asn Phe Glu Gln Lys Glu Val Pro Glu His Ala Thr Val Tyr
 355 360 365

Met Cys Gly Pro Ile Ser Met Met Lys Ala Leu Ala Lys Gln Ile Lys
 370 375 380

Lys Gln Asn Pro Lys Thr Glu His Ile Tyr
 385 390

<210> 59

<211> 900

<212> DNA

<213> Streptococcus pneumoniae

<400> 59

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 cgcaataaaa tcatgggaat ttacacgact gataaggagc aaattgtctt tatcgacaca 180
 ccagggattc acaagcctaa aacagctctc ggagatttca tggttgagtc tgcctacagt 240
 acccttcgcg aagtggacac tgtttttt atggtgcctg ctgatgaagc gcgtggtaag 300
 ggggacgata tgattatcga gcgctccaag gctgccaaagg ttctctgatg tttggtggtg 360
 aataaaatcg ataaggtcca tocagaccag ctcttgtctc agattgatga cttccgtaat 420
 caaatggact ttaaggaaat tgttccaatc tcagcccttc agggaaataa cgtgtctcgt 480
 ctagtggata ttttgagtga aaatctggat gaaggtttcc aatatttccc gtctgatcaa 540

atcacagacc atccagaacg tttcttggtt tcagaaatgg ttgcgcgagaa agtcttgcaac 600
 ctaactcgtg aagagattcc gcattctgta gcagtagttg ttgactctat gaaacgagac 660
 gaagagacag acaagggttca catccgtgca accatcatgg tcgagcgcga tagccaaaaa 720
 gggattatca tcggtaaagg tggcgctatg ctttaagaaaa tcggtagcat ggcccgtcgt 780
 gatatcgaac tcatgctagg agacaaggtc ttctagaaaa cctgggtcaa ggtcaagaaa 840
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<210> 60

<211> 299

<212> PRT

<213> Streptococcus pneumoniae

<400> 60

Met Thr Phe Lys Ser Gly Phe Val Ala Ile Leu Gly Arg Pro Asn Val

1

5

10

15

Gly Lys Ser Thr Phe Leu Asn His Val Met Gly Gln Lys Ile Ala Ile

20

25

30

Met Ser Asp Lys Ala Gln Thr Thr Arg Asn Lys Ile Met Gly Ile Tyr

35

40

45

Thr Thr Asp Lys Glu Gln Ile Val Phe Ile Asp Thr Pro Gly Ile His

50

55

60

Lys Pro Lys Thr Ala Leu Gly Asp Phe Met Val Glu Ser Ala Tyr Ser

65

70

75

80

Thr Leu Arg Glu Val Asp Thr Val Leu Phe Met Val Pro Ala Asp Glu

85

90

95

Ala Arg Gly Lys Gly Asp Asp Met Ile Ile Glu Arg Leu Lys Ala Ala

100

105

110

Lys Val Pro Val Ile Leu Val Val Asn Lys Ile Asp Lys Val His Pro

115

120

125

Asp Gln Leu Leu Ser Gln Ile Asp Asp Phe Arg Asn Gln Met Asp Phe
 130 135 140

Lys Glu Ile Val Pro Ile Ser Ala Leu Gln Gly Asn Asn Val Ser Arg
 145 150 155 160

Leu Val Asp Ile Leu Ser Glu Asn Leu Asp Glu Gly Phe Gln Tyr Phe
 165 170 175

Pro Ser Asp Gln Ile Thr Asp His Pro Glu Arg Phe Leu Val Ser Glu
 180 185 190

Met Val Arg Glu Lys Val Leu His Leu Thr Arg Glu Glu Ile Pro His
 195 200 205

Ser Val Ala Val Val Val Asp Ser Met Lys Arg Asp Glu Glu Thr Asp
 210 215 220

Lys Val His Ile Arg Ala Thr Ile Met Val Glu Arg Asp Ser Gln Lys
 225 230 235 240

Gly Ile Ile Ile Gly Lys Gly Gly Ala Met Leu Lys Lys Ile Gly Ser
 245 250 255

Met Ala Arg Arg Asp Ile Glu Leu Met Leu Gly Asp Lys Val Phe Leu
 260 265 270

Glu Thr Trp Val Lys Val Lys Lys Asn Trp Arg Asp Lys Lys Leu Asp
 275 280 285

Leu Ala Asp Phe Gly Tyr Asn Glu Arg Glu Tyr
 290 295

<210> 61

<211> 855

<212> DNA

<213> Streptococcus pneumoniae

<400> 61

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cccaagatga ttaagacgga tttggaagag tttcaaaggg aattgcctag tcagattatc 180
gagtcaatgg gacgtcgtgg aaaatatttg cttttttatc tgacagacaa ggtcttgatt 240
tcccatttgc ggatggaggg caagtatttt tactatccag accaaggacc tgaacgcaag 300
catgccccatg ttttctttca ttttgaagat ggtggcacgc ttgtttatga ggatgttcgc 360
aagtttggaa ccatggaaact cttggtgcct gaccttttag acgtctactt tatttctaaa 420
aaattaggtc ctgaaccaag cgaacaagac tttgatttac aggtctttca atctgccctt 480
gccaaagtcca aaaagcctat caaatcccat ctccatagacc agaccttggt agctggactt 540
ggcaatatct atgtggatga ggttctctgg cgagctcagg ttcattccagc tagaccttcc 600
cagactttga cagcagaaga agcgactgcc attcatgacc agaccattgc tgttttgggc 660
caggctgttg aaaaaggtgg ctccaccatt cggacttata ccaatgcctt tggggaagat 720
ggaagcatgc aggactttca tcaggtctat gataagactg gtcaagaatg tgtacgctgt 780
ggtaccatca ttgagaaaat tcaactaggc ggacgtggaa cccacttttg tccaaactgt 840
caaaggaggg actga 855

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<210> 62

<211> 284

<212> PRT

<213> Streptococcus pneumoniae

<400> 62

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Met Leu Leu Val Phe Thr Glu Gly Gly Leu Met Pro Glu Leu Pro Glu
  1             5             10             15

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Val Glu Thr Val Cys Arg Gly Leu Glu Lys Leu Ile Ile Gly Lys Lys
      20             25             30

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Ile Ser Ser Ile Glu Ile Arg Tyr Pro Lys Met Ile Lys Thr Asp Leu
    35             40             45

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Glu Glu Phe Gln Arg Glu Leu Pro Ser Gln Ile Ile Glu Ser Met Gly
 50 55 60

Arg Arg Gly Lys Tyr Leu Leu Phe Tyr Leu Thr Asp Lys Val Leu Ile
 65 70 75 80

Ser His Leu Arg Met Glu Gly Lys Tyr Phe Tyr Tyr Pro Asp Gln Gly
 85 90 95

Pro Glu Arg Lys His Ala His Val Phe Phe His Phe Glu Asp Gly Gly
 100 105 110

Thr Leu Val Tyr Glu Asp Val Arg Lys Phe Gly Thr Met Glu Leu Leu
 115 120 125

Val Pro Asp Leu Leu Asp Val Tyr Phe Ile Ser Lys Lys Leu Gly Pro
 130 135 140

Glu Pro Ser Glu Gln Asp Phe Asp Leu Gln Val Phe Gln Ser Ala Leu
 145 150 155 160

Ala Lys Ser Lys Lys Pro Ile Lys Ser His Leu Leu Asp Gln Thr Leu
 165 170 175

Val Ala Gly Leu Gly Asn Ile Tyr Val Asp Glu Val Leu Trp Arg Ala
 180 185 190

Gln Val His Pro Ala Arg Pro Ser Gln Thr Leu Thr Ala Glu Glu Ala
 195 200 205

Thr Ala Ile His Asp Gln Thr Ile Ala Val Leu Gly Gln Ala Val Glu
 210 215 220

Lys Gly Gly Ser Thr Ile Arg Thr Tyr Thr Asn Ala Phe Gly Glu Asp
 225 230 235 240

Gly Ser Met Gln Asp Phe His Gln Val Tyr Asp Lys Thr Gly Gln Glu
 245 250 255

Cys Val Arg Cys Gly Thr Ile Ile Glu Lys Ile Gln Leu Gly Gly Arg
 260 265 270

Gly Thr His Phe Cys Pro Asn Cys Gln Arg Arg Asp
 275 280

<210> 63

<211> 633

<212> DNA

<213> Streptococcus pneumoniae

<400> 63

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 gcctctggta agtcaactgt gacaaatttt ctaagacagc aaggctttca agtagtggat 120
 gccgacgcag tcgtccacca actacagaaa cctggtggtc gtctgtttga ggctctagta 180
 cagcactttg ggcaagaaat cattcttgaa aacggagAAC tcaatcgccc tctcctagct 240
 agtctcatct tttcaaattc tgatgaacga gaatgggtcta agcaaattca aggggagatt 300
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 atggatattc ccctactttt tgagcaggac tacagcgatt ggtttgctga gacttggttg 420
 gtctatgttg accgagatgc ccaagtggaa cgcttaatga aaagggaacca gttgtccaaa 480
 gatgaagctg agtctcgtct ggcagcccag tggcctttag aaaaaaagaa agatttggcc 540
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<210> 64

<211> 210

<212> PRT

<213> Streptococcus pneumoniae

<400> 64

Met Ser Lys Leu Ser Lys Glu Gly Leu Met Gly Lys Ile Ile Gly Ile
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Thr Gly Gly Ile Ala Ser Gly Lys Ser Thr Val Thr Asn Phe Leu Arg
 20 25 30

Gln Gln Gly Phe Gln Val Val Asp Ala Asp Ala Val Val His Gln Leu
 35 40 45

Gln Lys Pro Gly Gly Arg Leu Phe Glu Ala Leu Val Gln His Phe Gly
 50 55 60

Gln Glu Ile Ile Leu Glu Asn Gly Glu Leu Asn Arg Pro Leu Leu Ala
 65 70 75 80

Ser Leu Ile Phe Ser Asn Pro Asp Glu Arg Glu Trp Ser Lys Gln Ile
 85 90 95

Gln Gly Glu Ile Ile Arg Glu Glu Leu Ala Thr Leu Arg Glu Gln Leu
 100 105 110

Ala Gln Thr Glu Glu Ile Phe Phe Met Asp Ile Pro Leu Leu Phe Glu
 115 120 125

Gln Asp Tyr Ser Asp Trp Phe Ala Glu Thr Trp Leu Val Tyr Val Asp
 130 135 140

Arg Asp Ala Gln Val Glu Arg Leu Met Lys Arg Asp Gln Leu Ser Lys
 145 150 155 160

Asp Glu Ala Glu Ser Arg Leu Ala Ala Gln Trp Pro Leu Glu Lys Lys
 165 170 175

Lys Asp Leu Ala Ser Gln Val Leu Asp Asn Asn Gly Asn Gln Asn Gln
 180 185 190

Leu Leu Asn Gln Val His Ile Leu Leu Glu Gly Gly Arg Gln Asp Asp
 195 200 205

Arg Asp
 210

<210> 65

<211> 1269

<212> DNA

<213> Streptococcus pneumoniae

<400> 65

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gtaggcaaga tgacagagat taactggaag gataatctgc gcattgcctg gtttggtaat 120
tttctgacag gagccagtat ttctttgggt gtacotttta tgcccatctt cgtggaaaat 180
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gaaatctag                                     1269

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<210> 66

<211> 422

<212> PRT

<213> Streptococcus pneumoniae

<400> 66

Met Ile Ile Met Ala Ile Arg Thr Ser Phe Leu Ile Lys Cys Ile Ser

1

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10

15

Phe Leu Arg Glu Val Gly Lys Met Thr Glu Ile Asn Trp Lys Asp Asn
 20 25 30

Leu Arg Ile Ala Trp Phe Gly Asn Phe Leu Thr Gly Ala Ser Ile Ser
 35 40 45

Leu Val Val Pro Phe Met Pro Ile Phe Val Glu Asn Leu Gly Val Gly
 50 55 60

Ser Gln Gln Val Ala Phe Tyr Ala Gly Leu Ala Ile Ser Val Ser Ala
 65 70 75 80

Ile Ser Ala Ala Leu Phe Ser Pro Ile Trp Gly Ile Leu Ala Asp Lys
 85 90 95

Tyr Gly Arg Lys Pro Met Met Ile Arg Ala Gly Leu Ala Met Thr Ile
 100 105 110

Thr Met Gly Gly Leu Ala Phe Val Pro Asn Ile Tyr Trp Leu Ile Phe
 115 120 125

Leu Arg Leu Leu Asn Gly Val Phe Ala Gly Phe Val Pro Asn Ala Thr
 130 135 140

Ala Leu Ile Ala Ser Gln Val Pro Lys Glu Lys Ser Gly Ser Ala Leu
 145 150 155 160

Gly Thr Leu Ser Thr Gly Val Val Ala Gly Thr Leu Thr Gly Pro Phe
 165 170 175

Ile Gly Gly Phe Ile Ala Glu Leu Phe Gly Ile Arg Thr Val Phe Leu
 180 185 190

Leu Val Gly Ser Phe Leu Phe Leu Ala Ala Ile Leu Thr Ile Cys Phe
 195 200 205

Ile Lys Glu Asp Phe Gln Pro Val Ala Lys Glu Lys Ala Ile Pro Thr
 210 215 220

115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195 200 205 210 215 220

Lys Glu Leu Phe Thr Ser Val Lys Tyr Pro Tyr Leu Leu Leu Asn Leu
 225 230 235 240

Phe Leu Thr Ser Phe Val Ile Gln Phe Ser Ala Gln Ser Ile Gly Pro
 245 250 255

Ile Leu Ala Leu Tyr Val Arg Asp Leu Gly Gln Thr Glu Asn Leu Leu
 260 265 270

Phe Val Ser Gly Leu Ile Val Ser Ser Met Gly Phe Ser Ser Met Met
 275 280 285

Ser Ala Gly Val Met Gly Lys Leu Gly Asp Lys Val Gly Asn His Arg
 290 295 300

Leu Leu Val Val Ala Gln Phe Tyr Ser Val Ile Ile Tyr Leu Leu Cys
 305 310 315 320

Ala Asn Ala Ser Ser Pro Leu Gln Leu Gly Leu Tyr Arg Phe Leu Phe
 325 330 335

Gly Leu Gly Thr Gly Ala Leu Ile Pro Gly Val Asn Ala Leu Leu Ser
 340 345 350

Lys Met Thr Pro Lys Ala Gly Ile Ser Arg Val Phe Ala Phe Asn Gln
 355 360 365

Val Phe Phe Tyr Leu Gly Gly Val Val Gly Pro Met Ala Gly Ser Ala
 370 375 380

Val Ala Gly Gln Phe Gly Tyr His Ala Val Phe Tyr Ala Thr Ser Leu
 385 390 395 400

Cys Val Ala Phe Ser Cys Leu Phe Asn Leu Ile Gln Phe Arg Thr Leu
 405 410 415

Leu Lys Val Lys Glu Ile
 420

<210> 67

<211> 1311

<212> DNA

<213> Streptococcus pneumoniae

<400> 67

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gaaaatactg agaaatactc tgttatgcgt gccatgcgtg ctattgaccg ttcagatgtg 780
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gatgtcatca tggatgccat tgccatcaac ccaacaccga cagacaaagg aaaacgtctc 1140
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<210> 68

<211> 436

<212> PRT

<213> Streptococcus pneumoniae

<400> 68

Met Ala Leu Pro Thr Ile Ala Ile Val Gly Arg Pro Asn Val Gly Lys

1

5

10

15

Ser Thr Leu Phe Asn Arg Ile Ala Gly Glu Arg Ile Ser Ile Val Glu
 20 25 30

Asp Val Glu Gly Val Thr Arg Asp Arg Ile Tyr Ala Thr Gly Glu Trp
 35 40 45

Leu Asn Arg Ser Phe Ser Met Ile Asp Thr Gly Gly Ile Asp Asp Val
 50 55 60

Asp Ala Pro Phe Met Glu Gln Ile Lys His Gln Ala Glu Ile Ala Met
 65 70 75 80

Glu Glu Ala Asp Val Ile Val Phe Val Val Ser Gly Lys Glu Gly Ile
 85 90 95

Thr Asp Ala Asp Glu Tyr Val Ala Arg Lys Leu Tyr Lys Thr His Lys
 100 105 110

Pro Val Ile Leu Ala Val Asn Lys Val Asp Asn Pro Glu Met Arg Asn
 115 120 125

Asp Ile Tyr Asp Phe Tyr Ala Leu Gly Leu Gly Glu Pro Leu Pro Ile
 130 135 140

Ser Ser Val His Gly Ile Gly Thr Gly Asp Val Leu Asp Ala Ile Val
 145 150 155 160

Glu Asn Leu Pro Asn Glu Tyr Glu Glu Glu Asn Pro Asp Val Ile Lys
 165 170 175

Phe Ser Leu Ile Gly Arg Pro Asn Val Gly Lys Ser Ser Leu Ile Asn
 180 185 190

Ala Ile Leu Gly Glu Asp Arg Val Ile Ala Ser Pro Val Ala Gly Thr
 195 200 205

Thr Arg Asp Ala Ile Asp Thr His Phe Thr Asp Thr Asp Gly Gln Glu
 210 215 220

Phe Thr Met Ile Asp Thr Ala Gly Met Arg Lys Ser Gly Lys Val Tyr
 225 230 235 240

Glu Asn Thr Glu Lys Tyr Ser Val Met Arg Ala Met Arg Ala Ile Asp
 245 250 255

Arg Ser Asp Val Val Leu Met Val Ile Asn Ala Glu Glu Gly Ile Arg
 260 265 270

Glu Tyr Asp Lys Arg Ile Ala Gly Phe Ala His Glu Ala Gly Lys Gly
 275 280 285

Met Ile Ile Val Val Asn Lys Trp Asp Thr Leu Glu Lys Asp Asn His
 290 295 300

Thr Met Lys Asn Trp Glu Glu Asp Ile Arg Glu Gln Phe Gln Tyr Leu
 305 310 315 320

Pro Tyr Ala Pro Ile Ile Phe Val Ser Ala Leu Thr Lys Gln Arg Leu
 325 330 335

His Lys Leu Pro Glu Met Ile Lys Gln Ile Ser Glu Ser Gln Asn Thr
 340 345 350

Arg Ile Pro Ser Ala Val Leu Asn Asp Val Ile Met Asp Ala Ile Ala
 355 360 365

Ile Asn Pro Thr Pro Thr Asp Lys Gly Lys Arg Leu Lys Ile Phe Tyr
 370 375 380

Ala Thr Gln Val Ala Thr Lys Pro Pro Thr Phe Val Ile Phe Val Asn
 385 390 395 400

Glu Glu Glu Leu Met His Phe Ser Tyr Leu Arg Phe Leu Glu Asn Gln
 405 410 415

Ile Arg Lys Ala Phe Val Phe Glu Gly Thr Pro Ile His Leu Ile Ala
 420 425 430

Arg Lys Arg Lys

435

<210> 69

<211> 714

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 69

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aagaatttcc aatcctactc tgtgattgtg gtacgaagtc aagagaagaa agatgccttg 180
tatgaattgg tacctcaaga agccattcgc cagtctgctg ttttccttct ctttgtcgga 240
gatttgaacc gagcagaaaa gggagcccg cttcataccg acaccttcca accccaaggt 300
gtggaaggtc tcttgattag ttcggtcgat gcagctcttg ctggacaaaa cgccttggtg 360
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gaggaagaat accaagaaca gtcaactgag gcaatccaag cttatgaccg tgttcaggct 600
gactatgctg gggcgcgctgc gaccacaagc tggagtcagc gcctagcaga acagtttgggt 660
caagctgaac caagctcaac tagaaaaaat cttgaacaga agaaattatt gtag      714

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<210> 70

<211> 237

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 70

Met Thr Glu Thr Ile Lys Leu Met Lys Ala His Thr Ser Val Arg Arg

1

5

10

15

Phe Lys Glu Gln Glu Ile Pro Gln Val Asp Leu Asn Glu Ile Leu Thr

20

25

30

Ala Ala Gln Met Ala Ser Ser Trp Lys Asn Phe Gln Ser Tyr Ser Val
 35 40 45

Ile Val Val Arg Ser Gln Glu Lys Lys Asp Ala Leu Tyr Glu Leu Val
 50 55 60

Pro Gln Glu Ala Ile Arg Gln Ser Ala Val Phe Leu Leu Phe Val Gly
 65 70 75 80

Asp Leu Asn Arg Ala Glu Lys Gly Ala Arg Leu His Thr Asp Thr Phe
 85 90 95

Gln Pro Gln Gly Val Glu Gly Leu Leu Ile Ser Ser Val Asp Ala Ala
 100 105 110

Leu Ala Gly Gln Asn Ala Leu Leu Ala Ala Glu Ser Leu Gly Tyr Gly
 115 120 125

Gly Val Ile Ile Gly Leu Val Arg Tyr Lys Ser Glu Glu Val Ala Glu
 130 135 140

Leu Phe Asn Leu Pro Asp Tyr Thr Tyr Ser Val Phe Gly Met Ala Leu
 145 150 155 160

Gly Val Pro Asn Gln His His Asp Met Lys Pro Arg Leu Pro Leu Glu
 165 170 175

Asn Val Val Phe Glu Glu Glu Tyr Gln Glu Gln Ser Thr Glu Ala Ile
 180 185 190

Gln Ala Tyr Asp Arg Val Gln Ala Asp Tyr Ala Gly Ala Arg Ala Thr
 195 200 205

Thr Ser Trp Ser Gln Arg Leu Ala Glu Gln Phe Gly Gln Ala Glu Pro
 210 215 220

Ser Ser Thr Arg Lys Asn Leu Glu Gln Lys Lys Leu Leu
 225 230 235

<210> 71

<211> 729

<212> DNA

<213> Streptococcus pneumoniae

<400> 71

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atgacagaaa ttagactaga gcacgtcagt tatgcctatg gtcaggagag gattttagag 60
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atcttgaaaa atcgccctgg gcagattgtt tcagaaatta aactagattg gtctgaagat 660
gaggacaagg aagtccaaaa gattgcctac aaacgtcaaa ttttggcgga attaggctta 720
gataagtag                                     729

```

<210> 72

<211> 242

<212> PRT

<213> Streptococcus pneumoniae

<400> 72

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Met Thr Glu Ile Arg Leu Glu His Val Ser Tyr Ala Tyr Gly Gln Glu
  1               5               10              15

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Arg Ile Leu Glu Asp Ile Asn Leu Gln Val Thr Ser Gly Glu Val Val
      20               25              30

```

```

Ser Ile Leu Gly Pro Ser Gly Val Gly Lys Thr Thr Leu Phe Asn Leu
    35               40              45

```

Ile Ala Gly Ile Leu Glu Val Gln Ser Gly Arg Ile Val Leu Asp Gly
 50 55 60

Glu Glu Asn Pro Lys Gly Arg Val Ser Tyr Met Leu Gln Lys Asp Leu
 65 70 75 80

Leu Leu Glu His Lys Thr Val Leu Gly Asn Ile Ile Leu Pro Leu Leu
 85 90 95

Ile Gln Lys Val Asp Lys Ala Glu Ala Ile Ser Arg Ala Asp Lys Ile
 100 105 110

Leu Ala Thr Phe Gln Leu Thr Ala Val Arg Asp Lys Tyr Pro His Glu
 115 120 125

Leu Ser Gly Gly Met Arg Gln Arg Val Ala Leu Leu Arg Thr Tyr Leu
 130 135 140

Phe Gly His Lys Leu Phe Leu Leu Asp Glu Ala Phe Ser Ala Leu Asp
 145 150 155 160

Glu Met Thr Lys Met Glu Leu His Ala Trp Tyr Leu Glu Ile His Lys
 165 170 175

Gln Leu Gln Leu Thr Thr Leu Ile Ile Thr His Ser Ile Glu Glu Ala
 180 185 190

Leu Asn Leu Ser Asp Arg Ile Tyr Ile Leu Lys Asn Arg Pro Gly Gln
 195 200 205

Ile Val Ser Glu Ile Lys Leu Asp Trp Ser Glu Asp Glu Asp Lys Glu
 210 215 220

Val Gln Lys Ile Ala Tyr Lys Arg Gln Ile Leu Ala Glu Leu Gly Leu
 225 230 235 240

Asp Lys

<210> 73

<211> 2433

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 73

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 agtgtagcag gggcaacttt aaatgattat ccgtatgaga tggaccgttt agaagaggtg 180
 gctttggaac tgactgaaac ggactatagc caggatgaaa cctttacgga attgccgttc 240
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 gctgctcttc gtcgaaattht agaagaacgg gcaggctgga ctctggaaga tctcaaggct 480
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<210> 74

<211> 810

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 74

Met Asn Tyr Ser Lys Ala Leu Asn Glu Cys Ile Glu Ser Ala Tyr Met
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Val Ala Gly His Phe Gly Ala Arg Tyr Leu Glu Ser Trp His Leu Leu
 20 25 30

Ile Ala Met Ser Asn His Ser Tyr Ser Val Ala Gly Ala Thr Leu Asn
 35 40 45

Asp Tyr Pro Tyr Glu Met Asp Arg Leu Glu Glu Val Ala Leu Glu Leu
 50 55 60

Thr Glu Thr Asp Tyr Ser Gln Asp Glu Thr Phe Thr Glu Leu Pro Phe
 65 70 75 80

Ser Arg Arg Leu Gln Val Leu Phe Asp Glu Ala Glu Tyr Val Ala Ser
 85 90 95

101

Val Val His Ala Lys Val Leu Gly Thr Glu His Val Leu Tyr Ala Ile
100 105 110

Leu His Asp Ser Asn Ala Leu Ala Thr Arg Ile Leu Glu Arg Ala Gly
115 120 125

Phe Ser Tyr Glu Asp Lys Lys Asp Gln Val Lys Ile Ala Ala Leu Arg
130 135 140

Arg Asn Leu Glu Glu Arg Ala Gly Trp Thr Arg Glu Asp Leu Lys Ala
145 150 155 160

Leu Arg Gln Arg His Arg Thr Val Ala Asp Lys Gln Asn Ser Met Ala
165 170 175

Asn Met Met Gly Met Pro Gln Thr Pro Ser Gly Gly Leu Glu Asp Tyr
180 185 190

Thr His Asp Leu Thr Glu Gln Ala Arg Ser Gly Lys Leu Glu Pro Val
195 200 205

Ile Gly Arg Asp Lys Glu Ile Ser Arg Met Ile Gln Ile Leu Ser Arg
210 215 220

Lys Thr Lys Asn Asn Pro Val Leu Val Gly Asp Ala Gly Val Gly Lys
225 230 235 240

Thr Ala Leu Ala Leu Gly Leu Ala Gln Arg Ile Ala Ser Gly Asp Val
245 250 255

Pro Ala Glu Met Ala Lys Met Arg Val Leu Glu Leu Asp Leu Met Asn
260 265 270

Val Val Ala Gly Thr Arg Phe Arg Gly Asp Phe Glu Glu Arg Met Asn
275 280 285

Asn Ile Ile Lys Asp Ile Glu Glu Asp Gly Gln Val Ile Leu Phe Ile
290 295 300

Asp Glu Leu His Thr Ile Met Gly Ser Gly Ser Gly Ile Asp Ser Thr
305 310 315 320

Leu Asp Ala Ala Asn Ile Leu Lys Pro Ala Leu Ala Arg Gly Thr Leu
325 330 335

Arg Thr Val Gly Ala Thr Thr Gln Glu Glu Tyr Gln Lys His Ile Glu
340 345 350

Lys Asp Ala Ala Leu Ser Arg Arg Phe Ala Lys Val Thr Ile Glu Glu
355 360 365

Pro Ser Val Ala Asp Ser Met Thr Ile Leu Gln Gly Leu Lys Ala Thr
370 375 380

Tyr Glu Lys His His Arg Val Gln Ile Thr Asp Glu Ala Val Glu Thr
385 390 395 400

Ala Val Lys Met Ala His Arg Tyr Leu Thr Ser Arg His Leu Pro Asp
405 410 415

Ser Ala Ile Asp Leu Leu Asp Glu Ala Ala Ala Thr Val Gln Asn Lys
420 425 430

Ala Lys His Val Lys Ala Asp Asp Ser Asp Leu Ser Pro Ala Asp Lys
435 440 445

Ala Leu Met Asp Gly Lys Trp Lys Gln Ala Ala Gln Leu Ile Ala Lys
450 455 460

Glu Glu Glu Val Pro Val Tyr Lys Asp Leu Val Thr Glu Ser Asp Ile
465 470 475 480

Leu Thr Thr Leu Ser Arg Leu Ser Gly Ile Pro Val Gln Lys Leu Thr
485 490 495

Gln Thr Asp Ala Lys Lys Tyr Leu Asn Leu Glu Ala Glu Leu His Lys
500 505 510

Arg Val Ile Gly Gln Asp Gln Ala Val Ser Ser Ile Ser Arg Ala Ile
 515 520 525

Arg Arg Asn Gln Ser Gly Ile Arg Ser His Lys Arg Pro Ile Gly Ser
 530 535 540

Phe Met Phe Leu Gly Pro Thr Gly Val Gly Lys Thr Glu Leu Ala Lys
 545 550 555 560

Ala Leu Ala Glu Val Leu Phe Asp Asp Glu Ser Ala Leu Ile Arg Phe
 565 570 575

Asp Met Ser Glu Tyr Met Glu Lys Phe Ala Ala Ser Arg Leu Asn Gly
 580 585 590

Ala Pro Pro Gly Tyr Val Gly Tyr Glu Glu Gly Gly Glu Leu Thr Glu
 595 600 605

Lys Val Arg Asn Lys Pro Tyr Ser Val Leu Leu Phe Asp Glu Val Glu
 610 615 620

Lys Ala His Pro Asp Ile Phe Asn Val Leu Leu Gln Val Leu Asp Asp
 625 630 635 640

Gly Val Leu Thr Asp Ser Lys Gly Arg Lys Val Asp Phe Ser Asn Thr
 645 650 655

Ile Ile Ile Met Thr Ser Asn Leu Gly Ala Thr Ala Leu Arg Asp Asp
 660 665 670

Lys Thr Val Gly Phe Gly Ala Lys Asp Ile Arg Phe Asp Gln Glu Asn
 675 680 685

Met Glu Lys Arg Met Phe Glu Glu Leu Lys Lys Ala Tyr Arg Pro Glu
 690 695 700

Phe Ile Asn Arg Ile Asp Glu Lys Val Val Phe His Ser Leu Ser Ser
 705 710 715 720

Asp His Met Gln Glu Val Val Lys Ile Met Val Lys Pro Leu Val Ala
 725 730 735

Ser Leu Thr Glu Lys Gly Ile Asp Leu Lys Leu Gln Ala Ser Ala Leu
 740 745 750

Lys Leu Leu Ala Asn Gln Gly Tyr Asp Pro Glu Met Gly Ala Arg Pro
 755 760 765

Leu Arg Arg Thr Leu Gln Thr Glu Val Glu Asp Lys Leu Ala Glu Leu
 770 775 780

Leu Leu Lys Gly Asp Leu Val Ala Gly Ser Thr Leu Lys Ile Gly Val
 785 790 795 800

Lys Ala Gly Gln Leu Lys Phe Asp Ile Ala
 805 810

<210> 75

<211> 1008

<212> DNA

<213> Streptococcus pneumoniae

<400> 75

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 gactttatcc tagactggac accaaatacc aaccacacag ggctttatgt tgccaaggaa 180
 aaaggttatt tcaaagaagc tggagtggat gttgatttga aattgccacc agaagaaagt 240
 tcttctgact tggttatcaa cggaaaggca ccatttgcag tgtatttcca agactacatg 300
 gctaagaaat tggaaaaagg agcaggaatc actgccgttg cagctattgt tgaacacaat 360
 acatcaggaa tcatctctcg taaatctgat aatgtaagca gtccaaaaga cttgggttgg 420
 aagaaatatg ggacatggaa tgacccaact gaacttgcta tgttgaaaac cttggtagaa 480
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 acaccgattg ccaatggcgt ctttgatact gcttggtttt actacggttg ggatgggtatc 600
 cttgctaaat ctcaagggtg agatgctaac ttcatgtact tgaaagacta tgtcaaggag 660
 tttgactact attcaccagt tatcatcgca aacaacgact atctgaaaga taacaaagaa 720

gaagctcgca aagtcattcca agccatcaaa aaaggctacc aatatgccat ggaacatcca 780
gaagaagctg cagatattct catcaagaat gcacctgaac tcaaggaaaa acgtgacttt 840
gtcatcgaat ctcaaaaata cttgtcaaaa gaatacgcaa gcgacaagga aaaatggggt 900
caatttgacg cagctcgctg gaatgctttc tacaaatggg ataaagaaaa tggatcctt 960
aaagaagact tgacagacaa aggcttcacc aacgaatttg tgaaataa 1008

<210> 76

<211> 335

<212> PRT

<213> Streptococcus pneumoniae

<400> 76

Met Lys Lys Thr Trp Lys Val Phe Leu Thr Leu Val Thr Ala Leu Val
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Ala Val Val Leu Val Ala Cys Gly Gln Gly Thr Ala Ser Lys Asp Asn
20 25 30

Lys Glu Ala Glu Leu Lys Lys Val Asp Phe Ile Leu Asp Trp Thr Pro
35 40 45

Asn Thr Asn His Thr Gly Leu Tyr Val Ala Lys Glu Lys Gly Tyr Phe
50 55 60

Lys Glu Ala Gly Val Asp Val Asp Leu Lys Leu Pro Pro Glu Glu Ser
65 70 75 80

Ser Ser Asp Leu Val Ile Asn Gly Lys Ala Pro Phe Ala Val Tyr Phe
85 90 95

Gln Asp Tyr Met Ala Lys Lys Leu Glu Lys Gly Ala Gly Ile Thr Ala
100 105 110

Val Ala Ala Ile Val Glu His Asn Thr Ser Gly Ile Ile Ser Arg Lys
115 120 125

Ser Asp Asn Val Ser Ser Pro Lys Asp Leu Val Gly Lys Lys Tyr Gly
 130 135 140

Thr Trp Asn Asp Pro Thr Glu Leu Ala Met Leu Lys Thr Leu Val Glu
 145 150 155 160

Ser Gln Gly Gly Asp Phe Glu Lys Val Glu Lys Val Pro Asn Asn Asp
 165 170 175

Ser Asn Ser Ile Thr Pro Ile Ala Asn Gly Val Phe Asp Thr Ala Trp
 180 185 190

Ile Tyr Tyr Gly Trp Asp Gly Ile Leu Ala Lys Ser Gln Gly Val Asp
 195 200 205

Ala Asn Phe Met Tyr Leu Lys Asp Tyr Val Lys Glu Phe Asp Tyr Tyr
 210 215 220

Ser Pro Val Ile Ile Ala Asn Asn Asp Tyr Leu Lys Asp Asn Lys Glu
 225 230 235 240

Glu Ala Arg Lys Val Ile Gln Ala Ile Lys Lys Gly Tyr Gln Tyr Ala
 245 250 255

Met Glu His Pro Glu Glu Ala Ala Asp Ile Leu Ile Lys Asn Ala Pro
 260 265 270

Glu Leu Lys Glu Lys Arg Asp Phe Val Ile Glu Ser Gln Lys Tyr Leu
 275 280 285

Ser Lys Glu Tyr Ala Ser Asp Lys Glu Lys Trp Gly Gln Phe Asp Ala
 290 295 300

Ala Arg Trp Asn Ala Phe Tyr Lys Trp Asp Lys Glu Asn Gly Ile Leu
 305 310 315 320

Lys Glu Asp Leu Thr Asp Lys Gly Phe Thr Asn Glu Phe Val Lys
 325 330 335

<210> 77

<211> 762

<212> DNA

<213> Streptococcus pneumoniae

<400> 77

```

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acacctcttg aaattctcca gccctttggt cgtgacagag aatttctctg gcaccatagc 180
tgggcgacct tgagagtggc tttactgggg ctgattttgg gagttttgat tgcctgtctt 240
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attttgacg gttttaggca ttgcgacaag gatatgctga ccttgtttag tctgatgcgg 480
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gcaggctctga gggtcagtgt ctctacgcc tttatcacia ctgtggtatc tgagtgggtg 600
ggagggtttg aaggctcttg tgtttatatg attcagtcta aaaaactgtt tcagtatgat 660
accatgtttg ccattattat tctggtgtcg attatcagtc ttttgggtat gaagctggtc 720
gatatcagtg aaaaatatgt gattaaatgg aaacgttcgt ag 762

```

<210> 78

<211> 253

<212> PRT

<213> Streptococcus pneumoniae

<400> 78

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Met Met Arg Asn Leu Arg Ser Ile Leu Arg Arg His Ile Ser Leu Leu
  1             5             10             15

```

```

Gly Phe Leu Gly Val Leu Ser Ile Trp Gln Leu Ala Gly Phe Leu Lys
      20             25             30

```

```

Leu Leu Pro Lys Phe Ile Leu Pro Thr Pro Leu Glu Ile Leu Gln Pro
    35             40             45

```


Phe Val Arg Asp Arg Glu Phe Leu Trp His His Ser Trp Ala Thr Leu
 50 55 60

Arg Val Ala Leu Leu Gly Leu Ile Leu Gly Val Leu Ile Ala Cys Leu
 65 70 75 80

Met Ala Val Leu Met Asp Ser Leu Thr Trp Leu Asn Asp Leu Ile Tyr
 85 90 95

Pro Met Met Val Val Ile Gln Thr Ile Pro Thr Ile Ala Ile Ala Pro
 100 105 110

Ile Leu Val Leu Trp Leu Gly Tyr Gly Ile Leu Pro Lys Ile Val Leu
 115 120 125

Ile Ile Leu Thr Thr Thr Phe Pro Ile Ile Val Ser Ile Leu Asp Gly
 130 135 140

Phe Arg His Cys Asp Lys Asp Met Leu Thr Leu Phe Ser Leu Met Arg
 145 150 155 160

Ala Lys Pro Trp Gln Ile Leu Trp His Phe Lys Ile Pro Val Ser Leu
 165 170 175

Pro Tyr Phe Tyr Ala Gly Leu Arg Val Ser Val Ser Tyr Ala Phe Ile
 180 185 190

Thr Thr Val Val Ser Glu Trp Leu Gly Gly Phe Glu Gly Leu Gly Val
 195 200 205

Tyr Met Ile Gln Ser Lys Lys Leu Phe Gln Tyr Asp Thr Met Phe Ala
 210 215 220

Ile Ile Ile Leu Val Ser Ile Ile Ser Leu Leu Gly Met Lys Leu Val
 225 230 235 240

Asp Ile Ser Glu Lys Tyr Val Ile Lys Trp Lys Arg Ser
 245 250

<210> 79

<211> 372

<212> DNA

<213> Streptococcus pneumoniae

<400> 79

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gaagaactcg agtttcaatt gcttaataac caaggaaaga ttaccttcca cttttcaagt 240
caacacctcc ctacagccat tgattttgac ttttaaccatc ctttcgaccc tcgttatccc 300
ccaagagtac tggttttaga catggacggt agagaaacta tcctcctccc agaagaaaat 360
gacctatttt aa 372

```

<210> 80

<211> 123

<212> PRT

<213> Streptococcus pneumoniae

<400> 80

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Met Ile Phe Asn Pro Ile Cys Cys Met Ile Arg Glu Lys Lys Gly Asp
  1             5             10             15

```

```

Arg Asp Met Ala Phe Thr Asn Thr His Met Arg Ser Ala Ser Phe Gly
      20             25             30

```

```

Ile Val Thr Ser Leu Pro Asp Asp Ile Ile Asp Ser Phe Trp Tyr Ile
      35             40             45

```

```

Ile Asp His Phe Leu Lys Asn Val Phe Glu Leu Glu Glu Leu Glu
      50             55             60

```

```

Phe Gln Leu Leu Asn Asn Gln Gly Lys Ile Thr Phe His Phe Ser Ser
      65             70             75             80

```

110

Gln His Leu Pro Thr Ala Ile Asp Phe Asp Phe Asn His Pro Phe Asp
85 90 95

Pro Arg Tyr Pro Pro Arg Val Leu Val Leu Asp Met Asp Gly Arg Glu
100 105 110

Thr Ile Leu Leu Pro Glu Glu Asn Asp Leu Phe
115 120

<210> 81

<211> 1645

<212> DNA

<213> Streptococcus pneumoniae

<400> 81

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aaaggtgggg acttgctcgg tactattggc aatttcaatt ttgggaagcc aaggtatttt 180
atcggatgaa gttgttaacta gttcttcacc gatggctaca aaagagtctt ctaatgcaat 240
tactaatgat ttagataatt caccaactgt taatcagaat cgttctgctg aaatgattgc 300
ctctaattca accactaatg gtttagataa ttcgttaagt gttaatagca tcagctctaa 360
tggtactatt cgttccaatt cacaattaga caacagaaca gttgaatcta cagtaacatc 420
tactaatgaa aataagagtt ataaggaaga tggtataagt gacagaatta tcaaaaaaga 480
atttgaagat actgctttta gtgtaaaaga ttatgggtgca gtaggtgatg ggattcatga 540
tgatcgacaa gcaattcaag atgcaataga tgctgcagct caagggctag gtggaggaaa 600
tgtatatattt cctgaaggaa cttatattagt aaaagaaatt gtttttttaa aaagtcatac 660
acacttagaa ttgaatgaga aagctacaat tctaaatggg ataaatatta agaatcacc 720
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cacacactat caaacattgt cgacacagaa cccctctaat attaaaattc aaaataatca 1260

ttttgataac atgatgtatg caggtgtacg ttttacagga ttcaactgatg tattaatcaa 1320
 aggaaatcgc tttgataaga aagttaaagg agagagtgtg cattatcgag aaagcggagc 1380
 agcttttagta aatgcttata gctataaaaa cactaaagac ctattagatt taaataaaca 1440
 ggtgggttatc gccgaaaata tattttaatat tgccgatcct aaaacaaaag cgatacgagt 1500
 tgcaaaagat agtgcagaat gtttaggaaa agtatcagat attactgtaa caaaaaatgt 1560
 aattaataat aattctaagg aaacagaaca accaaatatt gaattattac gagttagtga 1620
 taatttagta gtctcagaga atagt 1645

<210> 82

<211> 548

<212> PRT

<213> Streptococcus pneumoniae

<400> 82

Gln Arg Cys His Ser Ile Tyr Phe Lys Lys Ser Asn Asn Gln Leu Leu
 1 5 10 15

Lys Ile Val Lys Lys Leu Glu Val Leu Met Lys Tyr Phe Val Pro Asn
 20 25 30

Glu Val Phe Ser Ile Arg Lys Leu Lys Val Gly Thr Cys Ser Val Leu
 35 40 45

Leu Ala Ile Ser Ile Leu Gly Ser Gln Gly Ile Leu Ser Asp Glu Val
 50 55 60

Val Thr Ser Ser Ser Pro Met Ala Thr Lys Glu Ser Ser Asn Ala Ile
 65 70 75 80

Thr Asn Asp Leu Asp Asn Ser Pro Thr Val Asn Gln Asn Arg Ser Ala
 85 90 95

Glu Met Ile Ala Ser Asn Ser Thr Thr Asn Gly Leu Asp Asn Ser Leu
 100 105 110

Ser Val Asn Ser Ile Ser Ser Asn Gly Thr Ile Arg Ser Asn Ser Gln
 115 120 125

Leu Asp Asn Arg Thr Val Glu Ser Thr Val Thr Ser Thr Asn Glu Asn
 130 135 140

Lys Ser Tyr Lys Glu Asp Val Ile Ser Asp Arg Ile Ile Lys Lys Glu
 145 150 155 160

Phe Glu Asp Thr Ala Leu Ser Val Lys Asp Tyr Gly Ala Val Gly Asp
 165 170 175

Gly Ile His Asp Asp Arg Gln Ala Ile Gln Asp Ala Ile Asp Ala Ala
 180 185 190

Ala Gln Gly Leu Gly Gly Gly Asn Val Tyr Phe Pro Glu Gly Thr Tyr
 195 200 205

Leu Val Lys Glu Ile Val Phe Leu Lys Ser His Thr His Leu Glu Leu
 210 215 220

Asn Glu Lys Ala Thr Ile Leu Asn Gly Ile Asn Ile Lys Asn His Pro
 225 230 235 240

Ser Ile Val Phe Met Thr Gly Leu Phe Thr Asp Asp Gly Ala Gln Val
 245 250 255

Glu Trp Gly Pro Thr Glu Asp Ile Ser Tyr Ser Gly Gly Thr Ile Asp
 260 265 270

Met Asn Gly Ala Leu Asn Glu Glu Gly Thr Lys Ala Lys Asn Leu Pro
 275 280 285

Leu Ile Asn Ser Ser Gly Ala Phe Ala Ile Gly Asn Ser Asn Asn Val
 290 295 300

Thr Ile Lys Asn Val Thr Phe Lys Asp Ser Tyr Gln Gly His Ala Ile
 305 310 315 320

Gln Ile Ala Gly Ser Lys Asn Val Leu Val Asp Asn Ser Arg Phe Leu
 325 330 335

Gly Gln Ala Leu Pro Lys Thr Met Lys Asp Gly Gln Ile Ile Ser Lys
 340 345 350

Glu Ser Ile Gln Ile Glu Pro Leu Thr Arg Lys Gly Phe Pro Tyr Ala
 355 360 365

Leu Asn Asp Asp Gly Lys Lys Ser Glu Asn Val Thr Ile Gln Asn Ser
 370 375 380

Tyr Phe Gly Lys Ser Asp Lys Ser Gly Glu Leu Val Thr Ala Ile Gly
 385 390 395 400

Thr His Tyr Gln Thr Leu Ser Thr Gln Asn Pro Ser Asn Ile Lys Ile
 405 410 415

Gln Asn Asn His Phe Asp Asn Met Met Tyr Ala Gly Val Arg Phe Thr
 420 425 430

Gly Phe Thr Asp Val Leu Ile Lys Gly Asn Arg Phe Asp Lys Lys Val
 435 440 445

Lys Gly Glu Ser Val His Tyr Arg Glu Ser Gly Ala Ala Leu Val Asn
 450 455 460

Ala Tyr Ser Tyr Lys Asn Thr Lys Asp Leu Leu Asp Leu Asn Lys Gln
 465 470 475 480

Val Val Ile Ala Glu Asn Ile Phe Asn Ile Ala Asp Pro Lys Thr Lys
 485 490 495

Ala Ile Arg Val Ala Lys Asp Ser Ala Glu Cys Leu Gly Lys Val Ser
 500 505 510

Asp Ile Thr Val Thr Lys Asn Val Ile Asn Asn Asn Ser Lys Glu Thr
 515 520 525

Glu Gln Pro Asn Ile Glu Leu Leu Arg Val Ser Asp Asn Leu Val Val
 530 535 540

Ser Glu Asn Ser

545

<210> 83

<211> 324

<212> DNA

<213> Streptococcus pneumoniae

<400> 83

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gtgatgaaag aaactcagct attaaaaggt gttcttgaag gttgtgtctt ggatatgatt 60
gggtcaaaaag agcgggtatgg ttatgagttg gttcagactt tgcgagaggc tggatttgat 120
actatcgttc caggaactat ttatcctttg ttgcaaaagt tagaaaaaaa tcaatggata 180
agaggcgaca tgcgcccgtc gccagatggg ccagatcgga agtatttttc attaatgaaa 240
gaaggagaag agcgtgtctc agtcttttgg caacaatggg acgatttgag tcaaaaagta 300
gaagggatta agaatggggg ttaa                                     324
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<210> 84

<211> 107

<212> PRT

<213> Streptococcus pneumoniae

<400> 84

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Met Met Lys Glu Thr Gln Leu Leu Lys Gly Val Leu Glu Gly Cys Val
  1              5              10              15
```

```
Leu Asp Met Ile Gly Gln Lys Glu Arg Tyr Gly Tyr Glu Leu Val Gln
      20              25              30
```

```
Thr Leu Arg Glu Ala Gly Phe Asp Thr Ile Val Pro Gly Thr Ile Tyr
      35              40              45
```

```
Pro Leu Leu Gln Lys Leu Glu Lys Asn Gln Trp Ile Arg Gly Asp Met
      50              55              60
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Arg Pro Ser Pro Asp Gly Pro Asp Arg Lys Tyr Phe Ser Leu Met Lys
 65 70 75 80

Glu Gly Glu Glu Arg Val Ser Val Phe Trp Gln Gln Trp Asp Asp Leu
 85 90 95

Ser Gln Lys Val Glu Gly Ile Lys Asn Gly Gly
 100 105

<210> 85

<211> 816

<212> DNA

<213> Streptococcus pneumoniae

<400> 85

atgaagaaaa tgaagtatta cgaagaaaca agcgctttgc tacatgagtt ttctgaggag 60
 aatcaaaagt attttgagga gttgtgggaa agttttaatc ttgctggatt tctctatgat 120
 gaagactatc tcagagagca gatctatttg atgatgctag atttctcaga agcagaacga 180
 gatggcatga gtgcagagga ttatctaggt aagaatccta aaaaaataat gaaagagatt 240
 ctcaagggag cacctcgcag ttctatcaaa gagtcccttt tgacgccaat tcttgtcctg 300
 gcggtattac gttattatca actactaagt gatttttcta aaggtcctct cttaacagtc 360
 aatttgctca catttttagg gcaacttctt atttttctga ttggatttgg acttgtggcc 420
 acaattttac gaagaagttt agtccaagat tctcctaaaa tgaaaattgg cacttacatt 480
 gttgttgga ctatagttct tctagttgtt ttaggatatg taggaatggc aagcttcata 540
 caagaaggag ccttttatat tccggctccc tgggatagtt tgtctgtctt tacgatttcg 600
 ctagtatatc gtatttggaa ttggaaagaa gcggtctttc gtccatttgt cagtatgatt 660
 attgcccac ttgtgggtggg ttctctgctc cgttattatg agtggatggg aatttcaaat 720
 gttttcctta caaaagttat tcctttagct gtcctcttta ttggaatctt tgtcttgttc 780
 cgtgggttta agaagataaa atggagtga gtatag 816

<210> 86

<211> 271

<212> PRT

<213> Streptococcus pneumoniae

<400> 86

Met Lys Lys Met Lys Tyr Tyr Glu Glu Thr Ser Ala Leu Leu His Glu
 1 5 10 15

Phe Ser Glu Glu Asn Gln Lys Tyr Phe Glu Glu Leu Trp Glu Ser Phe
 20 25 30

Asn Leu Ala Gly Phe Leu Tyr Asp Glu Asp Tyr Leu Arg Glu Gln Ile
 35 40 45

Tyr Leu Met Met Leu Asp Phe Ser Glu Ala Glu Arg Asp Gly Met Ser
 50 55 60

Ala Glu Asp Tyr Leu Gly Lys Asn Pro Lys Lys Ile Met Lys Glu Ile
 65 70 75 80

Leu Lys Gly Ala Pro Arg Ser Ser Ile Lys Glu Ser Leu Leu Thr Pro
 85 90 95

Ile Leu Val Leu Ala Val Leu Arg Tyr Tyr Gln Leu Leu Ser Asp Phe
 100 105 110

Ser Lys Gly Pro Leu Leu Thr Val Asn Leu Leu Thr Phe Leu Gly Gln
 115 120 125

Leu Leu Ile Phe Leu Ile Gly Phe Gly Leu Val Ala Thr Ile Leu Arg
 130 135 140

Arg Ser Leu Val Gln Asp Ser Pro Lys Met Lys Ile Gly Thr Tyr Ile
 145 150 155 160

Val Val Gly Thr Ile Val Leu Leu Val Val Leu Gly Tyr Val Gly Met
 165 170 175

Ala Ser Phe Ile Gln Glu Gly Ala Phe Tyr Ile Pro Ala Pro Trp Asp
 180 185 190

117

Ser Leu Ser Val Phe Thr Ile Ser Leu Val Ile Gly Ile Trp Asn Trp
195 200 205

Lys Glu Ala Val Phe Arg Pro Phe Val Ser Met Ile Ile Ala His Leu
210 215 220

Val Val Gly Ser Leu Leu Arg Tyr Tyr Glu Trp Met Gly Ile Ser Asn
225 230 235 240

Val Phe Leu Thr Lys Val Ile Pro Leu Ala Val Leu Phe Ile Gly Ile
245 250 255

Phe Val Leu Phe Arg Gly Phe Lys Lys Ile Lys Trp Ser Glu Val
260 265 270

<210> 87

<211> 348

<212> DNA

<213> Streptococcus pneumoniae

<400> 87

ctgttttttt atttatactc aatgaaaatc aaagagcaaa ctaggaagct agccgcaggt 60
tgctcaaaac actgttttga ggttgtagac gaaactgacg aagtcagctc aaaacatggt 120
tttgagggtg tagatgaaac tgacgaagtc agctcaaaac actgttttga ggttgtagat 180
gaaactgacg aagtcagctc aaaacactgt tttgagggtg tagatgaaac tgacgaagtc 240
agctcaaaac atgtttttga ggttgtagat gaaactgacg aagtcagtaa ccatacatc 300
ggtagggcga cgctgacgtg gtttgaagag attttcgaag agtattaa 348

<210> 88

<211> 115

<212> PRT

<213> Streptococcus pneumoniae

<400> 88

Met Phe Phe Tyr Leu Tyr Ser Met Lys Ile Lys Glu Gln Thr Arg Lys
1 5 10 15

Leu Ala Ala Gly Cys Ser Lys His Cys Phe Glu Val Val Asp Glu Thr
 20 25 30

Asp Glu Val Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp
 35 40 45

Glu Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu
 50 55 60

Val Ser Ser Lys His Cys Phe Glu Val Val Asp Glu Thr Asp Glu Val
 65 70 75 80

Ser Ser Lys His Val Phe Glu Val Val Asp Glu Thr Asp Glu Val Ser
 85 90 95

Asn His Thr Tyr Gly Arg Ala Thr Leu Thr Trp Phe Glu Glu Ile Phe
 100 105 110

Glu Glu Tyr
 115

<210> 89

<211> 1260

<212> DNA

<213> Streptococcus pneumoniae

<400> 89

atgcagaatc tgaaatttgc cttttcatct atcatggctc acaagatgcg ttctttgctt 60
 actatgattg ggattattat cgggtgttca tcagttgttg tgattatggc tttgggtgat 120
 tccctatctc gtcaagtcaa taaagatatg actaaatctc agaaaaatat tagcgtcttt 180
 ttctctccta aaaaaagtaa agacgggtct tttactcaga aacaatcagc ttttacggtt 240
 tctggaaagg aagaggaagt tcctgttgaa ccgcaaaaac cgcaagaatc ctgggtccaa 300
 gaggcagcta aactgaaggg agtggatagt tactatgtaa ccaattcaac gaatgccatc 360
 ttgacctatc aagataaaaa ggttgagaat gctaatttga caggtggaaa cagaacttac 420
 atggacgctg ttaagaatga aattattgca ggctgtagtc tgagagagca agatttcaaa 480
 gagtttgcaa gtgtcatttt gctagatgag gaattgtcca ttagtttatt tgaatctcct 540

caagaggcta ttaacaaggt tgtagaagtc aatggattta gttaccgggt cattgggggt 600
 tatactagtc cggaggctaa aagatcaaaa atatatgggt ttggtggctt gcctattact 660
 accaatatct cccttgctgc gaattttaat gtagatgaaa tagctaatat tgtctttcga 720
 gtgaatgata ccagtttaac cccaactctg ggtccagaac tggcacgaaa aatgacagag 780
 cttgcaggct tacaacaggg agaataccag gtggcagatg agtccgttgt atttgcagaa 840
 attcaacaat cgttttagttt tatgacgacg attattagtt ccatcgcagg gattttctctc 900
 tttgttggag gaactggtgt catgaacatc atgctggttt cggtgacaga gcgcactcgt 960
 gagattggtc ttcgtaaggc tttgggtgca acacgtgcca atattttaat tcagtttttg 1020
 attgaatcca tgattttgac cttggttaggt ggcttaattg gcttgacaat tgcaagtggg 1080
 ttaactgcct tagcaggttt gttactgcaa ggtttaatag aaggatataga agttggagta 1140
 tcaatcccag tcgccctatt tagtcttgca gtttcggcta gtgttggtat gatttttgga 1200
 gtcttgccag ccaacaaggc atcgaaactt gatccaattg aagcccttcg ttatgaatga 1260

<210> 90

<211> 419

<212> PRT

<213> Streptococcus pneumoniae

<400> 90

Met Gln Asn Leu Lys Phe Ala Phe Ser Ser Ile Met Ala His Lys Met

1

5

10

15

Arg Ser Leu Leu Thr Met Ile Gly Ile Ile Ile Gly Val Ser Ser Val

20

25

30

Val Val Ile Met Ala Leu Gly Asp Ser Leu Ser Arg Gln Val Asn Lys

35

40

45

Asp Met Thr Lys Ser Gln Lys Asn Ile Ser Val Phe Phe Ser Pro Lys

50

55

60

Lys Ser Lys Asp Gly Ser Phe Thr Gln Lys Gln Ser Ala Phe Thr Val

65

70

75

80

Ser Gly Lys Glu Glu Glu Val Pro Val Glu Pro Pro Lys Pro Gln Glu

85

90

95

120

Ser Trp Val Gln Glu Ala Ala Lys Leu Lys Gly Val Asp Ser Tyr Tyr
 100 105 110

Val Thr Asn Ser Thr Asn Ala Ile Leu Thr Tyr Gln Asp Lys Lys Val
 115 120 125

Glu Asn Ala Asn Leu Thr Gly Gly Asn Arg Thr Tyr Met Asp Ala Val
 130 135 140

Lys Asn Glu Ile Ile Ala Gly Arg Ser Leu Arg Glu Gln Asp Phe Lys
 145 150 155 160

Glu Phe Ala Ser Val Ile Leu Leu Asp Glu Glu Leu Ser Ile Ser Leu
 165 170 175

Phe Glu Ser Pro Gln Glu Ala Ile Asn Lys Val Val Glu Val Asn Gly
 180 185 190

Phe Ser Tyr Arg Val Ile Gly Val Tyr Thr Ser Pro Glu Ala Lys Arg
 195 200 205

Ser Lys Ile Tyr Gly Phe Gly Gly Leu Pro Ile Thr Thr Asn Ile Ser
 210 215 220

Leu Ala Ala Asn Phe Asn Val Asp Glu Ile Ala Asn Ile Val Phe Arg
 225 230 235 240

Val Asn Asp Thr Ser Leu Thr Pro Thr Leu Gly Pro Glu Leu Ala Arg
 245 250 255

Lys Met Thr Glu Leu Ala Gly Leu Gln Gln Gly Glu Tyr Gln Val Ala
 260 265 270

Asp Glu Ser Val Val Phe Ala Glu Ile Gln Gln Ser Phe Ser Phe Met
 275 280 285

Thr Thr Ile Ile Ser Ser Ile Ala Gly Ile Ser Leu Phe Val Gly Gly
 290 295 300

121

Thr Gly Val Met Asn Ile Met Leu Val Ser Val Thr Glu Arg Thr Arg
305 310 315 320

Glu Ile Gly Leu Arg Lys Ala Leu Gly Ala Thr Arg Ala Asn Ile Leu
325 330 335

Ile Gln Phe Leu Ile Glu Ser Met Ile Leu Thr Leu Leu Gly Gly Leu
340 345 350

Ile Gly Leu Thr Ile Ala Ser Gly Leu Thr Ala Leu Ala Gly Leu Leu
355 360 365

Leu Gln Gly Leu Ile Glu Gly Ile Glu Val Gly Val Ser Ile Pro Val
370 375 380

Ala Leu Phe Ser Leu Ala Val Ser Ala Ser Val Gly Met Ile Phe Gly
385 390 395 400

Val Leu Pro Ala Asn Lys Ala Ser Lys Leu Asp Pro Ile Glu Ala Leu
405 410 415

Arg Tyr Glu

<210> 91

<211> 705

<212> DNA

<213> Streptococcus pneumoniae

<400> 91

ctgatgaagc aactaattag tctaaaaaat atcttcagaa gttaccgtaa tgggtgaccaa 60
gaactgcagg ttctcaaaaa tatcaatcta gaagtgaatg aggggtgaatt tgtagccatc 120
atgggaccat ctgggtcttg taagtccact ctgatgaata cgattggcat gttggataca 180
ccaaccagtg gagaatatta tcttgaaggt caagaagtgg ctgggcttgg tgaaaaacaa 240
ctagctaagg tccgtaacca acaaatcggt tttgtctttc agcagttctt tcttctatcg 300
aagctcaatg ctctgcaaaa tgtagaattg cccttgattt acgcaggagt ttcgtcttca 360

aaacgtcgca agttggctga ggaatattta gacaagggtg aattgacaga acgtagtcac 420
 catttacctt cagaattatc tggtaggtcaa aagcaacgtg tagccattgc gcgtgccttg 480
 gtaaacaatc cttctattat cctagcggat gaaccgacag gagccttgga taccaaaaca 540
 ggtaacaaaa ttatgcaatt attggttgat ttgaataaag aaggaaaaac cattatcatg 600
 gtaacgcatg agcctgagat tgctgcctat gccaaacgtc agattgtcat tcgggatggg 660
 gtcatttcgt ctgacagtgc tcagtttaga aaggaggaaa actaa 705

<210> 92

<211> 234

<212> PRT

<213> Streptococcus pneumoniae

<400> 92

Met Met Lys Gln Leu Ile Ser Leu Lys Asn Ile Phe Arg Ser Tyr Arg
 1 5 10 15

Asn Gly Asp Gln Glu Leu Gln Val Leu Lys Asn Ile Asn Leu Glu Val
 20 25 30

Asn Glu Gly Glu Phe Val Ala Ile Met Gly Pro Ser Gly Ser Gly Lys
 35 40 45

Ser Thr Leu Met Asn Thr Ile Gly Met Leu Asp Thr Pro Thr Ser Gly
 50 55 60

Glu Tyr Tyr Leu Glu Gly Gln Glu Val Ala Gly Leu Gly Glu Lys Gln
 65 70 75 80

Leu Ala Lys Val Arg Asn Gln Gln Ile Gly Phe Val Phe Gln Gln Phe
 85 90 95

Phe Leu Leu Ser Lys Leu Asn Ala Leu Gln Asn Val Glu Leu Pro Leu
 100 105 110

Ile Tyr Ala Gly Val Ser Ser Ser Lys Arg Arg Lys Leu Ala Glu Glu
 115 120 125

123

Tyr Leu Asp Lys Val Glu Leu Thr Glu Arg Ser His His Leu Pro Ser
130 135 140

Glu Leu Ser Gly Gly Gln Lys Gln Arg Val Ala Ile Ala Arg Ala Leu
145 150 155 160

Val Asn Asn Pro Ser Ile Ile Leu Ala Asp Glu Pro Thr Gly Ala Leu
165 170 175

Asp Thr Lys Thr Gly Asn Gln Ile Met Gln Leu Leu Val Asp Leu Asn
180 185 190

Lys Glu Gly Lys Thr Ile Ile Met Val Thr His Glu Pro Glu Ile Ala
195 200 205

Ala Tyr Ala Lys Arg Gln Ile Val Ile Arg Asp Gly Val Ile Ser Ser
210 215 220

Asp Ser Ala Gln Leu Gly Lys Glu Glu Asn
225 230

<210> 93

<211> 1200

<212> DNA

<213> Streptococcus pneumoniae

<400> 93

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agtgtagttg tattgggtgc tggggggatt ttactcttta gacaaccttc tcagactgct 120
ctaaaagatg agcctactca tcttggtgtt gccaaaggaag gaagcgtggc ctctctgtt 180
ttattgtcag ggacagtaac agcaaaaaat gaacaatatg tttattttga tgctagtaag 240
ggtgatattag atgaaatcct tgtttctgtg ggcgataagg tcagcgaagg gcaggcttta 300
gtcaagtaca gtagttcaga agcgcaggcg gcctatgatt cagctagtcg agcagtagct 360
agggcagatc gtcatatcaa tgaactcaat caagcacgaa atgaagccgc ttcagctccg 420
gtccacagt taccagcgcc agtaggagga gaagatgcaa cggtgcaaag cccaactcca 480
gtggctggaa attctgttgc ttctattgac gctcaattgg gtgatgccc tgatgcgcgt 540

gcagatgctg cggcgcaatt aagcaaggct caaagtcaat tggatgcaac aactgttctc 600
 agtaccctag agggaaactgt ggtcgaagtc aatagcaatg tttctaaatc tccaacaggg 660
 gcgagtcaag ttatggttca tattgtcagc aatgaaaatt tacaagtcaa gggagaattg 720
 tctgagtaca atctagccaa cctttctgta ggtcaagaag taagctttac ttctaaagtg 780
 tatcctgata aaaaatggac tgggaaatta agctatatct ctgactatcc taaaaacaat 840
 ggtgaagcag ctagtccagc agccgggaat aatacagggt ctaaataccc ttatactatt 900
 gatgtgacag gcgaggttgg tgatttgaaa caagggtttt ctgtcaacat tgagggttaa 960
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 gctgacgcag aaaatcaaga aatcacttct ggtttaacga acggtgctaa ggtcatcagt 1140
 aatccaacat cttccttgga agaaggaaaa gaggtgaagg ctgatgaagc aactaattag 1200

<210> 94

<211> 399

<212> PRT

<213> Streptococcus pneumoniae

<400> 94

Met Lys Lys Lys Asn Gly Lys Ala Lys Lys Trp Gln Leu Tyr Ala Ala
 1 5 10 15

Ile Gly Ala Ala Ser Val Val Val Leu Gly Ala Gly Gly Ile Leu Leu
 20 25 30

Phe Arg Gln Pro Ser Gln Thr Ala Leu Lys Asp Glu Pro Thr His Leu
 35 40 45

Val Val Ala Lys Glu Gly Ser Val Ala Ser Ser Val Leu Leu Ser Gly
 50 55 60

Thr Val Thr Ala Lys Asn Glu Gln Tyr Val Tyr Phe Asp Ala Ser Lys
 65 70 75 80

Gly Asp Leu Asp Glu Ile Leu Val Ser Val Gly Asp Lys Val Ser Glu
 85 90 95

125

Gly Gln Ala Leu Val Lys Tyr Ser Ser Ser Glu Ala Gln Ala Ala Tyr
100 105 110

Asp Ser Ala Ser Arg Ala Val Ala Arg Ala Asp Arg His Ile Asn Glu
115 120 125

Leu Asn Gln Ala Arg Asn Glu Ala Ala Ser Ala Pro Ala Pro Gln Leu
130 135 140

Pro Ala Pro Val Gly Gly Glu Asp Ala Thr Val Gln Ser Pro Thr Pro
145 150 155 160

Val Ala Gly Asn Ser Val Ala Ser Ile Asp Ala Gln Leu Gly Asp Ala
165 170 175

Arg Asp Ala Arg Ala Asp Ala Ala Ala Gln Leu Ser Lys Ala Gln Ser
180 185 190

Gln Leu Asp Ala Thr Thr Val Leu Ser Thr Leu Glu Gly Thr Val Val
195 200 205

Glu Val Asn Ser Asn Val Ser Lys Ser Pro Thr Gly Ala Ser Gln Val
210 215 220

Met Val His Ile Val Ser Asn Glu Asn Leu Gln Val Lys Gly Glu Leu
225 230 235 240

Ser Glu Tyr Asn Leu Ala Asn Leu Ser Val Gly Gln Glu Val Ser Phe
245 250 255

Thr Ser Lys Val Tyr Pro Asp Lys Lys Trp Thr Gly Lys Leu Ser Tyr
260 265 270

Ile Ser Asp Tyr Pro Lys Asn Asn Gly Glu Ala Ala Ser Pro Ala Ala
275 280 285

Gly Asn Asn Thr Gly Ser Lys Tyr Pro Tyr Thr Ile Asp Val Thr Gly
290 295 300

Glu Val Gly Asp Leu Lys Gln Gly Phe Ser Val Asn Ile Glu Val Lys
 305 310 315 320

Ser Lys Thr Lys Ala Ile Leu Val Pro Val Ser Ser Leu Val Met Asp
 325 330 335

Asp Ser Lys Asn Tyr Val Trp Ile Val Asp Glu Gln Gln Lys Ala Lys
 340 345 350

Lys Val Glu Val Ser Leu Gly Asn Ala Asp Ala Glu Asn Gln Glu Ile
 355 360 365

Thr Ser Gly Leu Thr Asn Gly Ala Lys Val Ile Ser Asn Pro Thr Ser
 370 375 380

Ser Leu Glu Glu Gly Lys Glu Val Lys Ala Asp Glu Ala Thr Asn
 385 390 395

<210> 95

<211> 759

<212> DNA

<213> Streptococcus pneumoniae

<400> 95

atgtcacgta aaccatztat cgctggtaac tggaaaatga acaaaaatcc agaagaagct 60
 aaagcattcg ttgaagcagt tgcatacaaa cttccttcat cagatcttgt tgaagcaggt 120
 atcgctgctc cagctcttga tttgacaact gttcttgctg ttgcaaaagg ctcaaactt 180
 aaagttgctg ctcaaaactg ctactttgaa aatgcagggtg ctttactggt tgaaactagc 240
 ccacaagttt tgaaagaaat cgggtactgac tacgttggtta tcgggtcactc agaacgccgt 300
 gactacttcc atgaaactga tgaagatatc aacaaaaaag caaaagcaat ctttgcgaa 360
 ggtatgcttc caatcatctg ttgtggtgaa tcacttgaaa cttacgaagc tggtaaagct 420
 gctgaattcg taggtgctca agtatctgct gcattggctg gattgactgc tgaacaagtt 480
 gctgcctcag ttatcgctta tgagccaatc tgggctatcg gtactggtaa atcagcttca 540
 caagacgatg cacaaaaaat gtgtaaagtt gttcgtgacg ttgtagctgc tgactttggt 600
 caagaagtcg cagacaaagt tcgtgttcaa tacggtggtt ctgttaaacc tgaaaatggt 660
 gcttcataca tggcttgccc agacgttgac ggtgcccttg taggtggtgc gtcacttgaa 720

gctgaaagct tcttggttt gcttgacttt gtaaaataa

759

<210> 96

<211> 252

<212> PRT

<213> Streptococcus pneumoniae

<400> 96

Met Ser Arg Lys Pro Phe Ile Ala Gly Asn Trp Lys Met Asn Lys Asn
 1 5 10 15

Pro Glu Glu Ala Lys Ala Phe Val Glu Ala Val Ala Ser Lys Leu Pro
 20 25 30

Ser Ser Asp Leu Val Glu Ala Gly Ile Ala Ala Pro Ala Leu Asp Leu
 35 40 45

Thr Thr Val Leu Ala Val Ala Lys Gly Ser Asn Leu Lys Val Ala Ala
 50 55 60

Gln Asn Cys Tyr Phe Glu Asn Ala Gly Ala Phe Thr Gly Glu Thr Ser
 65 70 75 80

Pro Gln Val Leu Lys Glu Ile Gly Thr Asp Tyr Val Val Ile Gly His
 85 90 95

Ser Glu Arg Arg Asp Tyr Phe His Glu Thr Asp Glu Asp Ile Asn Lys
 100 105 110

Lys Ala Lys Ala Ile Phe Ala Asn Gly Met Leu Pro Ile Ile Cys Cys
 115 120 125

Gly Glu Ser Leu Glu Thr Tyr Glu Ala Gly Lys Ala Ala Glu Phe Val
 130 135 140

Gly Ala Gln Val Ser Ala Ala Leu Ala Gly Leu Thr Ala Glu Gln Val
 145 150 155 160

128

Ala Ala Ser Val Ile Ala Tyr Glu Pro Ile Trp Ala Ile Gly Thr Gly
165 170 175

Lys Ser Ala Ser Gln Asp Asp Ala Gln Lys Met Cys Lys Val Val Arg
180 185 190

Asp Val Val Ala Ala Asp Phe Gly Gln Glu Val Ala Asp Lys Val Arg
195 200 205

Val Gln Tyr Gly Gly Ser Val Lys Pro Glu Asn Val Ala Ser Tyr Met
210 215 220

Ala Cys Pro Asp Val Asp Gly Ala Leu Val Gly Gly Ala Ser Leu Glu
225 230 235 240

Ala Glu Ser Phe Leu Ala Leu Leu Asp Phe Val Lys
245 250

<210> 97

<211> 1473

<212> DNA

<213> Streptococcus pneumoniae

<400> 97

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<210> 98

<211> 490

<212> PRT

<213> Streptococcus pneumoniae

<400> 98

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 35 40 45

Lys Thr Gln Thr Ser Ala Glu Val Gln Thr Asn Ala Ala Ala His Trp
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Asp Gly Asp Tyr Tyr Val Lys Asp Asp Gly Ser Lys Ala Gln Ser Glu
 65 70 75 80

Trp Ile Phe Asp Asn Tyr Tyr Lys Ala Trp Phe Tyr Ile Asn Ser Asp
 85 90 95

130

Gly Arg Tyr Ser Gln Asn Glu Trp His Gly Asn Tyr Tyr Leu Lys Ser
100 105 110

Gly Gly Tyr Met Ala Gln Asn Glu Trp Ile Tyr Asp Ser Asn Tyr Lys
115 120 125

Ser Trp Phe Tyr Leu Lys Ser Asp Gly Ala Tyr Ala His Gln Glu Trp
130 135 140

Gln Leu Ile Gly Asn Lys Trp Tyr Tyr Phe Lys Lys Trp Gly Tyr Met
145 150 155 160

Ala Lys Ser Gln Trp Gln Gly Ser Tyr Phe Leu Asn Gly Gln Gly Ala
165 170 175

Met Met Gln Asn Glu Trp Leu Tyr Asp Pro Ala Tyr Ser Ala Tyr Phe
180 185 190

Tyr Leu Lys Ser Asp Gly Thr Tyr Ala Asn Gln Glu Trp Gln Lys Val
195 200 205

Gly Gly Lys Trp Tyr Tyr Phe Lys Lys Trp Gly Tyr Met Ala Arg Asn
210 215 220

Glu Trp Gln Gly Asn Tyr Tyr Leu Thr Gly Ser Gly Ala Met Ala Thr
225 230 235 240

Asp Glu Val Ile Met Asp Gly Thr Arg Tyr Ile Phe Ala Ala Ser Gly
245 250 255

Glu Leu Lys Glu Lys Lys Asp Leu Asn Val Gly Trp Val His Arg Asp
260 265 270

Gly Lys Arg Tyr Phe Phe Asn Asn Arg Glu Glu Gln Val Gly Thr Glu
275 280 285

His Ala Lys Lys Val Ile Asp Ile Ser Glu His Asn Gly Arg Ile Asn
290 295 300

131

Asp Trp Lys Lys Val Ile Asp Glu Asn Glu Val Asp Gly Val Ile Val
305 310 315 320

Arg Leu Gly Tyr Ser Gly Lys Glu Asp Lys Glu Leu Ala His Asn Ile
325 330 335

Lys Glu Leu Asn Arg Leu Gly Ile Pro Tyr Gly Val Tyr Leu Tyr Thr
340 345 350

Tyr Ala Glu Asn Glu Thr Asp Ala Glu Ser Asp Ala Lys Gln Thr Ile
355 360 365

Glu Leu Ile Lys Lys Tyr Asn Met Asn Leu Ser Tyr Pro Ile Tyr Tyr
370 375 380

Asp Val Glu Asn Trp Glu Tyr Val Asn Lys Ser Lys Arg Ala Pro Ser
385 390 395 400

Asp Thr Gly Thr Trp Val Lys Ile Ile Asn Lys Tyr Met Asp Thr Met
405 410 415

Lys Gln Ala Gly Tyr Gln Asn Val Tyr Val Tyr Ser Tyr Arg Ser Leu
420 425 430

Leu Gln Thr Arg Leu Lys His Pro Asp Ile Leu Lys His Val Asn Trp
435 440 445

Val Ala Ala Tyr Thr Asn Ala Leu Glu Trp Glu Asn Pro His Tyr Ser
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Gly Lys Lys Gly Trp Gln Tyr Thr Ser Ser Glu Tyr Met Lys Gly Ile
465 470 475 480

Gln Gly Arg Val Asp Val Ser Val Trp Tyr
485 490

<210> 99

<211> 774

<212> DNA

<213> Streptococcus pneumoniae

<400> 99

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<210> 100

<211> 257

<212> PRT

<213> Streptococcus pneumoniae

<400> 100

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Tyr Leu Pro Ile Phe Tyr Leu Ile Gly Tyr Ala Phe Asn Ala Gly Asp

20

25

30

Asp Met Asn Ser Phe Thr Gly Phe Ser Trp Thr His Phe Glu Thr Met

35

40

45

Phe Gly Asp Gly Arg Leu Met Leu Ile Leu Ala Gln Thr Phe Phe Leu

50

55

60

133

Ala Phe Leu Ser Ala Leu Ile Ala Thr Ile Ile Gly Thr Phe Gly Ala
65 70 75 80

Ile Tyr Ile Tyr Gln Ser Arg Lys Lys Tyr Gln Glu Ala Phe Leu Ser
85 90 95

Leu Asn Asn Ile Leu Met Val Ala Pro Asp Val Met Ile Gly Ala Ser
100 105 110

Phe Leu Ile Leu Phe Thr Gln Leu Lys Phe Ser Leu Gly Phe Leu Thr
115 120 125

Val Leu Ser Ser His Val Ala Phe Ser Ile Pro Ile Val Val Leu Met
130 135 140

Val Leu Pro Arg Leu Lys Glu Met Asn Gly Asp Met Ile His Ala Ala
145 150 155 160

Tyr Asp Leu Gly Ala Ser Gln Phe Gln Met Phe Lys Glu Ile Met Leu
165 170 175

Pro Tyr Leu Thr Pro Ser Ile Ile Thr Gly Tyr Phe Met Ala Phe Thr
180 185 190

Tyr Ser Leu Asp Asp Phe Ala Val Thr Phe Phe Val Thr Gly Asn Gly
195 200 205

Phe Ser Thr Leu Ser Val Glu Ile Tyr Ser Arg Ala Arg Lys Gly Ile
210 215 220

Ser Leu Glu Ile Asn Ala Leu Ser Ala Leu Val Phe Leu Phe Ser Ile
225 230 235 240

Ile Leu Val Val Gly Tyr Tyr Phe Ile Ser Arg Glu Lys Glu Glu Gln
245 250 255

Ala

<210> 101

<211> 1071

<212> DNA

<213> Streptococcus pneumoniae

<400> 101

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<210> 102

<211> 356

<212> PRT

<213> Streptococcus pneumoniae

<400> 102

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135

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20 25 30

Asp Ser Gln Lys Leu Val Ile Tyr Asn Trp Gly Asp Tyr Ile Asp Pro
35 40 45

Glu Leu Leu Thr Gln Phe Thr Glu Glu Thr Gly Ile Gln Val Gln Tyr
50 55 60

Glu Thr Phe Asp Ser Asn Glu Ala Met Tyr Thr Lys Ile Lys Gln Gly
65 70 75 80

Gly Thr Thr Tyr Asp Ile Ala Ile Pro Ser Glu Tyr Met Ile Asn Lys
85 90 95

Met Lys Asp Glu Asp Leu Leu Val Pro Leu Asp Tyr Ser Lys Ile Glu
100 105 110

Gly Ile Glu Asn Ile Gly Pro Glu Phe Leu Asn Gln Ser Phe Asp Pro
115 120 125

Gly Asn Lys Phe Ser Ile Pro Tyr Phe Trp Gly Thr Leu Gly Ile Val
130 135 140

Tyr Asn Glu Thr Met Val Asp Glu Ala Pro Glu His Trp Asp Asp Leu
145 150 155 160

Trp Lys Pro Glu Tyr Lys Asn Ser Ile Met Leu Phe Asp Gly Ala Arg
165 170 175

Glu Val Leu Gly Leu Gly Leu Asn Ser Leu Gly Tyr Ser Leu Asn Ser
180 185 190

Lys Asp Leu Gln Gln Leu Glu Glu Thr Val Asp Lys Leu Tyr Lys Leu
195 200 205

Thr Pro Asn Ile Lys Ala Ile Val Ala Asp Glu Met Lys Gly Tyr Met
210 215 220

136

Ile Gln Asn Asn Val Ala Ile Gly Val Thr Phe Ser Gly Glu Ala Ser
225 230 235 240

Gln Met Leu Glu Lys Asn Glu Asn Leu Arg Tyr Val Val Pro Thr Glu
 245 250 255

Ala Ser Asn Leu Trp Phe Asp Asn Met Val Ile Pro Lys Thr Val Lys
 260 265 270

Asn Gln Asn Ser Ala Tyr Ala Phe Ile Asn Phe Met Leu Lys Pro Glu
 275 280 285

Asn Ala Leu Gln Asn Ala Glu Tyr Val Gly Tyr Ser Thr Pro Asn Leu
 290 295 300

Pro Ala Lys Glu Leu Leu Pro Glu Glu Thr Lys Glu Asp Lys Ala Phe
305 310 315 320

Tyr Pro Asp Val Glu Thr Met Lys His Leu Glu Val Tyr Glu Lys Phe
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Asp His Lys Trp Thr Gly Lys Tyr Ser Asp Leu Phe Leu Gln Phe Lys
 340 345 350

Met Tyr Arg Lys
 355

<210> 103

<211> 1851

<212> DNA

<213> Streptococcus pneumoniae

<400> 103

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<210> 104

<211> 616

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 104

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Met Val Val Ser Ile Ile Val Ser Tyr Ile Leu Phe Tyr Gly Leu Ile
 35 40 45

Asn Pro Ala Pro Val Asp Tyr Ile Ile Tyr Thr Ser Leu Ala Phe Leu
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Phe Tyr Gln Leu Met Ile Gly Phe Trp Gly Leu Asn Ala Ser Ile Ser
 65 70 75 80

Arg Tyr Ser Lys Ile Thr Asp Phe Met Lys Ile Phe Phe Gly Val Thr
 85 90 95

Ala Ser Ser Val Leu Ser Tyr Ser Ile Cys Tyr Ala Phe Leu Pro Leu
 100 105 110

Phe Ser Ile Arg Phe Ile Ile Leu Phe Ile Leu Leu Ser Thr Phe Leu
 115 120 125

Ile Leu Leu Pro Arg Ile Thr Trp Gln Leu Ile Tyr Ser Arg Arg Lys
 130 135 140

Lys Gly Ser Gly Asp Gly Glu His Arg Arg Thr Phe Leu Ile Gly Ala
 145 150 155 160

Gly Asp Gly Gly Ala Leu Phe Met Asp Ser Tyr Gln His Pro Thr Ser
 165 170 175

Glu Leu Glu Leu Val Gly Ile Leu Asp Lys Asp Ser Lys Lys Lys Gly
 180 185 190

Gln Lys Leu Gly Gly Ile Pro Val Leu Gly Ser Tyr Asp Asn Leu Pro
 195 200 205

Glu Leu Ala Lys Arg His Gln Ile Glu Arg Val Ile Val Ala Ile Pro
 210 215 220

Ser Leu Asp Pro Ser Glu Tyr Glu Arg Ile Leu Gln Met Cys Asn Lys
 225 230 235 240

Leu Gly Val Lys Cys Tyr Lys Met Pro Lys Val Glu Thr Val Val Gln
 245 250 255

Gly Leu His Gln Ala Gly Thr Gly Phe Gln Lys Ile Asp Ile Thr Asp
 260 265 270

Leu Leu Gly Arg Gln Glu Ile Arg Leu Asp Glu Ser Arg Leu Gly Ala
 275 280 285

Glu Leu Thr Gly Lys Thr Ile Leu Val Thr Gly Ala Gly Gly Ser Ile
 290 295 300

Gly Ser Glu Ile Cys Arg Gln Val Ser Arg Phe Asn Pro Glu Arg Ile
 305 310 315 320

Val Leu Leu Gly His Gly Glu Asn Ser Ile Tyr Leu Val Tyr His Glu
 325 330 335

Leu Ile Arg Lys Phe Gln Gly Ile Asp Tyr Val Pro Val Ile Ala Asp
 340 345 350

Ile Gln Asp Tyr Asp Arg Leu Leu Gln Val Phe Glu Gln Tyr Lys Pro
 355 360 365

Ala Ile Val Tyr His Ala Ala Ala His Lys His Val Pro Met Met Glu
 370 375 380

Arg Asn Pro Lys Glu Ala Phe Lys Asn Asn Ile Arg Gly Thr Tyr Asn
 385 390 395 400

Val Ala Lys Ala Val Asp Glu Ala Lys Val Ser Lys Met Val Met Ile
 405 410 415

Ser Thr Asp Lys Ala Val Asn Pro Pro Asn Val Met Gly Ala Thr Lys
 420 425 430

Arg Val Ala Glu Leu Ile Val Thr Gly Phe Asn Gln Arg Ser Gln Ser
 435 440 445

Thr Tyr Cys Ala Val Arg Phe Gly Asn Val Leu Gly Ser Arg Gly Ser
 450 455 460

Val Ile Pro Val Phe Glu Arg Gln Ile Ala Glu Gly Gly Pro Val Thr
 465 470 475 480

Val Thr Asp Phe Arg Met Thr Arg Tyr Phe Met Thr Ile Pro Glu Ala
 485 490 495

Ser Arg Leu Val Ile His Ala Gly Ala Tyr Ala Lys Asp Gly Glu Val
 500 505 510

Phe Ile Leu Asp Met Gly Lys Pro Val Lys Ile Tyr Asp Leu Ala Lys
 515 520 525

Lys Met Val Leu Leu Ser Gly His Thr Glu Ser Glu Ile Pro Ile Val
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Glu Val Gly Ile Arg Pro Gly Glu Lys Leu Tyr Glu Glu Leu Leu Val
 545 550 555 560

Ser Thr Glu Leu Val Asp Asn Gln Val Met Asp Lys Ile Phe Val Gly
 565 570 575

Lys Val Asn Val Met Pro Leu Glu Ser Ile Asn Gln Lys Ile Gly Glu
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Ala Asn Gln Thr Thr His Ile Glu
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<210> 105

<211> 1338

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 105

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1338

<210> 106

<211> 445

<212> PRT

<213> Streptococcus pneumoniae

<400> 106

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 35 40 45

Leu Gly Tyr Glu Asp Gly Lys Pro Leu Tyr Phe Asn Gln Val Pro Val
 50 55 60

Ser Asp Phe Trp Glu Ile Leu Gly Asp Asn Gln Ser Ala Cys Ile Glu
 65 70 75 80

Asp Val Thr Gln Glu Arg Ala Val Ile His Tyr Ala Asp Gly Met Gln
 85 90 95

Ala Arg Leu Val Lys Gln Val Asp Trp Lys Asp Leu Glu Gly Arg Val
 100 105 110

Arg Gln Val Asp His Tyr Asn Arg Phe Gly Ala Cys Phe Ala Thr Thr
 115 120 125

Thr Tyr Ser Ala Asp Ser Glu Pro Ile Met Thr Val Tyr Gln Asp Val
 130 135 140

Asn Gly Gln Gln Val Leu Leu Glu Asn His Val Thr Gly Asp Ile Leu
 145 150 155 160

Leu Thr Leu Pro Gly Gln Ser Met Arg Tyr Phe Ala Asn Lys Val Glu
 165 170 175

Phe Ile Thr Phe Phe Leu Gln Asp Leu Glu Ile Asp Thr Ser Gln Leu
 180 185 190

Ile Phe Asn Thr Leu Ala Thr Pro Phe Leu Val Ser Phe His His Pro
 195 200 205

Asp Lys Ser Gly Ser Asp Val Leu Val Trp Gln Glu Pro Leu Tyr Asp
 210 215 220

Ala Ile Pro Gly Asn Met Gln Leu Ile Leu Glu Ser Asp Asn Val Arg
 225 230 235 240

Thr Lys Lys Ile Ile Ile Pro Asn Lys Ala Thr Tyr Glu Arg Ala Leu
 245 250 255

Glu Leu Thr Asp Glu Lys Tyr His Asp Gln Phe Val His Leu Gly Tyr
 260 265 270

His Tyr Gln Phe Lys Arg Asp Asn Phe Leu Arg Arg Asp Ala Leu Ile
 275 280 285

Leu Thr Asn Ser Asp Gln Ile Glu Gln Val Glu Ala Ile Ala Gly Ala
 290 295 300

Leu Pro Asp Val Thr Phe Arg Ile Ala Ala Val Thr Glu Met Ser Ser
 305 310 315 320

Lys Leu Leu Asp Met Leu Cys Tyr Pro Asn Val Ala Leu Tyr Gln Asn
 325 330 335

Ala Ser Pro Gln Lys Ile Gln Glu Leu Tyr Gln Leu Ser Asp Ile Tyr
 340 345 350

Leu Asp Ile Asn His Ser Asn Glu Leu Leu Gln Ala Val Arg Gln Ala
 355 360 365

Phe Glu His Asn Leu Leu Ile Leu Gly Phe Asn Gln Thr Val His Asn
 370 375 380

Arg Leu Tyr Ile Ala Pro Asp His Leu Phe Glu Ser Ser Glu Val Ala
 385 390 395 400

Ala Leu Val Glu Thr Ile Lys Leu Ala Leu Ser Asp Val Asp Gln Met
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<210> 107

<211> 1512

<212> DNA

<213> Streptococcus pneumoniae

<400> 107

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<211> 503

<212> PRT

<213> Streptococcus pneumoniae

<400> 108

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Gln His Leu Thr Ala Asn Ile Gly Phe Asp Asp Asn Gln Val Ile Trp
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Leu Tyr Asn His Phe Thr Asp Ile Lys Ile Ala Pro Thr Ser Val Thr
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Val Asp Asp Val Leu Ala Tyr Phe Gly Gly Glu Glu Ser His Arg Glu
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Lys Asn Gly Lys Val Leu Arg Val Phe Phe Phe Asp Gln Asp Lys Phe
 100 105 110

Val Thr Cys Tyr Leu Val Asp Glu Asn Lys Asp Leu Val Gln His Ala
 115 120 125

Glu Tyr Val Phe Lys Gly Asn Leu Ile Arg Lys Asp Tyr Phe Ser Tyr
 130 135 140

Thr Arg Tyr Cys Ser Glu Tyr Phe Ala Pro Lys Asp Asn Val Ala Val
 145 150 155 160

Leu Tyr Gln Arg Thr Phe Tyr Asn Glu Asp Gly Thr Pro Val Tyr Asp
 165 170 175

Ile Leu Met Asn Gln Gly Lys Glu Glu Val Tyr His Phe Lys Asp Lys
 180 185 190

Ile Phe Tyr Gly Lys Gln Ala Phe Val Arg Ala Phe Met Lys Ser Leu
 195 200 205

Asn Leu Asn Lys Ser Asp Leu Val Ile Leu Asp Arg Glu Thr Gly Ile
 210 215 220

Gly Gln Val Val Phe Glu Glu Ala Gln Thr Ala His Leu Ala Val Val
 225 230 235 240

Val His Ala Glu His Tyr Ser Glu Asn Ala Thr Asn Glu Asp Tyr Ile
 245 250 255

Leu Trp Asn Asn Tyr Tyr Asp Tyr Gln Phe Thr Asn Ala Asp Lys Val
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Asp Phe Phe Ile Val Ser Thr Asp Arg Gln Asn Glu Val Leu Gln Glu
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Gln Phe Ala Lys Tyr Thr Gln His Gln Pro Lys Ile Val Thr Ile Pro
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Val Gly Ser Ile Asp Ser Leu Thr Asp Ser Ser Gln Gly Arg Lys Pro
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147

Phe Ser Leu Ile Thr Ala Ser Arg Leu Ala Lys Glu Lys His Ile Asp
325 330 335

Trp Leu Val Lys Ala Val Ile Glu Ala His Lys Glu Leu Pro Glu Leu
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Thr Phe Asp Ile Tyr Gly Ser Gly Gly Glu Asp Ser Leu Leu Arg Glu
355 360 365

Ile Ile Ala Asn His Gln Ala Glu Asp Tyr Ile Gln Leu Lys Gly His
370 375 380

Ala Glu Leu Ser Gln Ile Tyr Ser Gln Tyr Glu Val Tyr Leu Thr Ala
385 390 395 400

Ser Thr Ser Glu Gly Phe Gly Leu Thr Leu Met Glu Ala Ile Gly Ser
405 410 415

Gly Leu Pro Leu Ile Gly Phe Asp Val Pro Tyr Gly Asn Gln Thr Phe
420 425 430

Ile Glu Asp Gly Gln Asn Gly Tyr Leu Ile Pro Ser Ser Ser Asp His
435 440 445

Val Glu Asp Gln Ile Lys Gln Ala Tyr Ala Ala Lys Ile Cys Gln Leu
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Tyr Gln Glu Asn Arg Leu Glu Ala Met Arg Ala Tyr Ser Tyr Gln Ile
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Ala Glu Gly Phe Leu Thr Lys Glu Ile Leu Glu Lys Trp Lys Lys Thr
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<210> 109

<211> 2292

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 109

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<210> 110

<211> 763

<212> PRT

<213> Streptococcus pneumoniae

<400> 110

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Val Ala Glu Met Asn Thr Gly Glu Gly Lys Thr Leu Thr Ala Thr Met
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Pro Val Tyr Leu Asn Ala Phe Ser Gly Glu Gly Val Met Val Val Thr
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Pro Asn Glu Tyr Leu Ser Lys Arg Asp Ala Glu Glu Met Gly Gln Val
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Tyr Arg Phe Leu Gly Leu Thr Ile Gly Val Pro Phe Thr Glu Asp Pro
115 120 125

150

Lys Lys Glu Met Lys Ala Glu Glu Lys Lys Leu Ile Tyr Ala Ser Asp
130 135 140

Ile Ile Tyr Thr Thr Asn Ser Asn Leu Gly Phe Asp Tyr Leu Asn Asp
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Val Ile Ile Asp Glu Ile Asp Asp Ile Leu Leu Asp Ser Ala Gln Thr
180 185 190

Pro Leu Ile Ile Ala Gly Ser Pro Arg Val Gln Ser Asn Tyr Tyr Ala
195 200 205

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Pro Glu Lys Val Tyr Ala Ser Leu Glu Tyr Ile Lys Gln Tyr His Ala
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Lys Gly Asn Pro Leu Leu Val Phe Val Gly Ser Val Glu Met Ser Gln
 405 410 415

Leu Tyr Ser Ser Leu Leu Phe Arg Glu Gly Ile Ala His Asn Val Leu
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Asn Ala Asn Asn Ala Ala Arg Glu Ala Gln Ile Ile Ser Glu Ser Gly
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Gln Met Gly Ala Val Thr Val Ala Thr Ser Met Ala Gly Arg Gly Thr
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Asp Ile Lys Leu Gly Lys Gly Val Ala Glu Leu Gly Gly Leu Ile Val
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Ile Gly Thr Glu Arg Met Glu Ser Gln Arg Ile Asp Leu Gln Ile Arg
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Gly Arg Ser Gly Arg Gln Gly Asp Pro Gly Met Ser Lys Phe Phe Val
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Ser Leu Glu Asp Asp Val Ile Lys Lys Phe Gly Pro Ser Trp Val His
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Lys Lys Tyr Lys Asp Tyr Gln Val Gln Asp Met Thr Gln Pro Glu Val
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Leu Lys Gly Arg Lys Tyr Arg Lys Leu Val Glu Lys Ala Gln His Ala
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Ser Asp Ser Ala Gly Arg Ser Ala Arg Arg Gln Thr Leu Glu Tyr Ala
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Glu Ser Met Asn Ile Gln Arg Asp Ile Val Tyr Lys Glu Arg Asn Arg
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Leu Ile Asp Gly Ser Arg Asp Leu Glu Asp Val Val Val Asp Ile Ile
 595 600 605

Glu Arg Tyr Thr Glu Glu Val Ala Ala Asp His Tyr Ala Ser Arg Glu
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Leu Leu Phe His Phe Ile Val Thr Asn Ile Ser Phe His Val Lys Glu
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Val Pro Asp Tyr Ile Asp Val Thr Asp Lys Thr Ala Val Arg Ser Phe
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Asn Gln His Asp Leu Tyr Glu Gln Phe Leu Arg Leu Ser Leu Leu Lys
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Ala Ile Asp Asp Asn Trp Val Glu Gln Val Asp Tyr Leu Gln Gln Leu
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Ser Met Ala Ile Gly Gly Gln Ser Ala Ser Gln Lys Asn Pro Ile Val
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Glu Tyr Tyr Gln Glu Ala Tyr Ala Gly Phe Glu Ala Met Lys Glu Gln
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<210> 111

<211> 879

<212> DNA

<213> Streptococcus pneumoniae

<400> 111

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<211> 292

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<400> 112

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Glu Arg Ile Pro Asp Leu Asp Thr Pro Ile Glu Lys Asn Thr Gln Leu
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Glu Glu Glu Val Ser Gln Ala Glu Val Glu Leu Glu Ser Gln Gln Glu
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Glu Lys Ile Glu Ala Pro Glu Asp Ser Glu Ala Arg Thr Glu Ile Glu
 65 70 75 80

Glu Lys Lys Ala Ser Asn Ser Thr Glu Glu Glu Pro Asp Leu Ser Lys
 85 90 95

Glu Thr Glu Lys Val Thr Ile Ala Glu Glu Ser Gln Glu Ala Leu Pro
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Gln Gln Lys Ala Thr Thr Lys Glu Pro Leu Leu Ile Ser Lys Ser Leu
 115 120 125

Glu Ser Pro Tyr Ile Pro Asp Gln Ala Pro Lys Ser Arg Asp Lys Trp
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Lys Glu Gln Val Leu Asp Phe Trp Ser Trp Leu Val Glu Ala Ile Lys
 145 150 155 160

Ser Pro Thr Ser Lys Leu Glu Thr Ser Ile Thr His Ser Tyr Thr Ala
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Phe Leu Leu Leu Ile Leu Phe Ser Ala Ser Ser Phe Phe Phe Ser Ile
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Tyr His Ile Lys His Ala Tyr Tyr Gly His Ile Ala Ser Ile Asn Ser
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Arg Phe Pro Glu Gln Leu Ala Pro Leu Thr Leu Phe Ser Ile Ile Ser
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155

Ile Leu Val Ala Thr Thr Leu Phe Phe Phe Ser Phe Leu Leu Gly Ser
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Phe Val Val Arg Arg Phe Ile His Gln Glu Lys Asp Trp Thr Leu Asp
245 250 255

Lys Val Leu Gln Gln Tyr Ser Gln Leu Leu Ala Ile Pro Ile Ser Ser
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Pro Ser Cys Val
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<210> 113

<211> 327

<212> DNA

<213> Streptococcus pneumoniae

<400> 113

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<210> 114

<211> 108

<212> PRT

<213> Streptococcus pneumoniae

<400> 114

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Lys Leu Ile Ala Asn Ile Lys Glu Ser Thr Leu Tyr Pro Ile Leu Lys
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Lys Leu Glu Gly Asn Ser Phe Leu Thr Thr Tyr Ser Arg Glu Phe Gln
 50 55 60

Gly Arg Met Arg Lys Tyr Tyr Ser Leu Thr Asn Gly Gly Ile Glu Gln
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Gly Ile Ile Glu Gly Ser Ile Arg His Asp Lys Asn
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<210> 115

<211> 954

<212> DNA

<213> Streptococcus pneumoniae

<400> 115

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<210> 116

<211> 317

<212> PRT

<213> Streptococcus pneumoniae

<400> 116

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20

25

30

Val Glu Gln Asn Ser Ile Tyr Leu Asp Gly Glu Thr Glu Leu Asn Gln

35

40

45

Val Lys Asp Asn Asn Gln Ala Leu Lys Arg Leu Ala Leu Arg Lys Glu

50

55

60

Glu Trp Leu Lys Thr Tyr Gln Phe Leu Leu Met Lys Ala Gly Gln Thr

65

70

75

80

Glu Pro Leu Gln Ala Asn His Gln Phe Thr Pro Asp Ala Ile Ala Leu

85

90

95

Leu Leu Val Phe Ile Val Glu Glu Leu Phe Lys Glu Glu Glu Ile Thr

100

105

110

Ile Leu Glu Met Gly Ser Gly Met Gly Ile Leu Gly Ala Ile Phe Leu

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Thr Ser Leu Thr Lys Lys Val Asp Tyr Leu Gly Met Glu Val Asp Asp

130

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140

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Ala Gly Phe Val Gln Gly Asp Ala Val Arg Pro Gln Met Leu Lys Glu
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Ser Asp Val Val Ile Ser Asp Leu Pro Val Gly Tyr Tyr Pro Asp Asp
180 185 190

Ala Val Ala Ser Arg His Gln Val Ala Ser Ser Gln Glu His Thr Tyr
195 200 205

Ala His His Leu Leu Met Glu Gln Gly Leu Lys Tyr Leu Lys Ser Asp
210 215 220

Gly Tyr Ala Ile Phe Leu Ala Pro Ser Asp Leu Leu Thr Ser Pro Gln
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Ser Asp Leu Leu Lys Glu Trp Leu Lys Glu Glu Ala Ser Leu Val Ala
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Met Ile Ser Leu Pro Glu Asn Leu Phe Ala Asn Ala Lys Gln Ser Lys
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Thr Ile Phe Ile Leu Gln Lys Lys Asn Glu Ile Ala Val Glu Pro Phe
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<210> 117

<211> 1902

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 117

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gaagctatgc ttgagtggga agaattatca gaggaggtgt aa 1902

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<210> 118

<211> 633

<212> PRT

<213> Streptococcus pneumoniae

<400> 118

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20

25

30

Ala Leu Val Gly Lys Asn Gly Ala Gly Lys Ser Thr Leu Leu Lys Ile

35

40

45

Leu Val Gly Glu Glu Glu Pro Thr Ser Gly Glu Ile Asn Lys Lys Lys

50

55

60

Asp Ile Ser Leu Ser Tyr Leu Ala Gln Asp Ser Arg Phe Glu Ser Glu

65

70

75

80

Asn Thr Ile Tyr Asp Glu Met Leu His Val Phe Asn Asp Leu Arg Arg

85

90

95

Thr Glu Arg Gln Leu Arg Gln Met Glu Leu Glu Met Gly Glu Lys Ser

100

105

110

Gly Glu Asp Leu Asp Lys Leu Met Ser Asp Tyr Asp Arg Leu Ser Glu

115

120

125

Asn Phe Arg Gln Ala Gly Gly Phe Thr Tyr Glu Ala Asp Ile Arg Ala

130

135

140

Ile Leu Asn Gly Phe Lys Phe Asp Glu Ser Met Trp Gln Met Lys Ile

145

150

155

160

161

Ala Glu Leu Ser Gly Gly Gln Asn Thr Arg Leu Ala Leu Ala Lys Met
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Leu Leu Glu Lys Pro Asn Leu Leu Val Leu Asp Glu Pro Thr Asn His
180 185 190

Leu Asp Ile Glu Thr Ile Ala Trp Leu Glu Asn Tyr Leu Val Asn Tyr
195 200 205

Ser Gly Ala Leu Ile Ile Val Ser His Asp Arg Tyr Phe Leu Asp Lys
210 215 220

Val Ala Thr Ile Thr Leu Asp Leu Thr Lys His Ser Leu Asp Arg Tyr
225 230 235 240

Val Gly Asn Tyr Ser Arg Phe Val Glu Leu Lys Glu Gln Lys Leu Val
245 250 255

Thr Glu Ala Lys Asn Tyr Glu Lys Gln Gln Lys Glu Ile Ala Ala Leu
260 265 270

Glu Asp Phe Val Asn Arg Asn Leu Val Arg Ala Ser Thr Thr Lys Arg
275 280 285

Ala Gln Ser Arg Arg Lys Gln Leu Glu Lys Met Glu Arg Leu Asp Lys
290 295 300

Pro Glu Ala Gly Lys Lys Ala Ala Asn Met Thr Phe Gln Ser Glu Lys
305 310 315 320

Thr Ser Gly Asn Val Val Leu Thr Val Glu Asn Ala Ala Val Gly Tyr
325 330 335

Asp Gly Glu Val Leu Ser Gln Pro Ile Asn Leu Asp Leu Arg Lys Met
340 345 350

Asn Ala Val Ala Ile Val Gly Pro Asn Gly Ile Gly Lys Ser Thr Phe
355 360 365

Ile Lys Ser Ile Val Asp Gln Ile Pro Phe Ile Lys Gly Glu Lys Arg
 370 375 380

Phe Gly Ala Asn Val Glu Val Gly Tyr Tyr Asp Gln Thr Gln Ser Lys
 385 390 395 400

Leu Thr Pro Ser Asn Thr Val Leu Asp Glu Leu Trp Asn Asp Phe Lys
 405 410 415

Leu Thr Pro Glu Val Glu Ile Arg Asn Arg Leu Gly Ala Phe Leu Phe
 420 425 430

Ser Gly Asp Asp Val Lys Lys Ser Val Gly Met Leu Ser Gly Gly Glu
 435 440 445

Lys Ala Arg Leu Leu Leu Ala Lys Leu Ser Met Glu Asn Asn Asn Phe
 450 455 460

Leu Ile Leu Asp Glu Pro Thr Asn His Leu Asp Ile Asp Ser Lys Glu
 465 470 475 480

Val Leu Glu Asn Ala Leu Ile Asp Phe Asp Gly Thr Leu Leu Phe Val
 485 490 495

Ser His Asp Arg Tyr Phe Ile Asn Arg Val Ala Thr His Val Leu Glu
 500 505 510

Leu Ser Glu Asn Gly Ser Thr Leu Tyr Leu Gly Asp Tyr Asp Tyr Tyr
 515 520 525

Val Glu Lys Lys Ala Thr Ala Glu Met Ser Gln Thr Glu Glu Ala Ser
 530 535 540

Thr Ser Asn Gln Ala Lys Glu Ala Ser Pro Val Asn Asp Tyr Gln Ala
 545 550 555 560

Gln Lys Glu Ser Gln Lys Glu Val Arg Lys Leu Met Arg Gln Ile Glu
 565 570 575

Ser Leu Glu Ala Glu Ile Glu Glu Leu Glu Ser Gln Ser Gln Ala Ile
 580 585 590

Ser Glu Gln Met Leu Glu Thr Asn Asp Ala Asp Lys Leu Met Glu Leu
 595 600 605

Gln Ala Glu Leu Asp Lys Ile Ser His Arg Gln Glu Glu Ala Met Leu
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Glu Trp Glu Glu Leu Ser Glu Gln Val
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<210> 119

<211> 1179

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 119

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<210> 120

<211> 392

<212> PRT

<213> Streptococcus pneumoniae

<400> 120

Met Asn Arg Tyr Ala Val Gln Leu Ile Ser Arg Gly Ala Ile Asn Lys
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Met Gly Thr Ile Gly Gln Thr Val Leu Gly Met Tyr Gln Ile Ser Glu
 35 40 45

Leu Val Thr Ser Ile Leu Val Asn Pro Phe Gly Gly Val Ile Ser Asp
 50 55 60

Arg Phe Ser Arg Arg Lys Ile Leu Met Thr Ala Asp Leu Val Cys Gly
 65 70 75 80

Ile Leu Cys Leu Ala Ile Ser Phe Ile Arg Asn Asp Ser Trp Met Ile
 85 90 95

Gly Ala Leu Ile Val Ala Asn Ile Val Gln Ala Ile Ala Phe Ala Phe
 100 105 110

Ser Arg Thr Ala Asn Lys Ala Ile Ile Thr Glu Val Val Glu Lys Asp
 115 120 125

Glu Ile Val Ile Tyr Asn Ser Arg Leu Glu Leu Val Leu Gln Val Val
 130 135 140

165

Gly Val Ser Ser Pro Val Leu Ser Phe Leu Val Leu Gln Phe Ala Ser
145 150 155 160

Leu His Met Thr Leu Leu Leu Asp Ser Leu Thr Phe Phe Ile Ala Phe
165 170 175

Val Leu Val Ala Phe Leu Pro Lys Glu Glu Ala Lys Val Gln Glu Lys
180 185 190

Lys Ala Phe Thr Gly Arg Asp Ile Phe Val Asp Ile Lys Asp Gly Leu
195 200 205

His Tyr Ile Trp His Gln Gln Glu Ile Phe Phe Leu Leu Leu Val Ala
210 215 220

Ser Ser Val Asn Phe Phe Phe Ala Ala Phe Glu Phe Leu Leu Pro Phe
225 230 235 240

Ser Asn Gln Leu Tyr Gly Ser Glu Gly Ala Tyr Ala Ser Ile Leu Thr
245 250 255

Met Gly Ala Ile Gly Ser Ile Ile Gly Ala Leu Leu Ala Ser Lys Ile
260 265 270

Lys Ala Asn Ile Tyr Asn Leu Leu Ile Leu Leu Ala Leu Thr Gly Val
275 280 285

Gly Val Phe Met Met Gly Leu Pro Leu Pro Thr Phe Leu Ser Phe Ser
290 295 300

Gly Asn Leu Val Cys Glu Leu Phe Met Thr Ile Phe Asn Ile His Phe
305 310 315 320

Phe Thr Gln Val Gln Thr Lys Val Glu Ser Glu Phe Leu Gly Arg Val
325 330 335

Leu Ser Thr Ile Phe Thr Leu Ala Ile Leu Phe Met Pro Ile Ala Lys
340 345 350

Gly Phe Met Thr Val Leu Pro Ser Val His Leu Tyr Ser Phe Leu Ile
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 370 375 380

Arg Thr His Phe Glu Lys Leu Ile
 385 390

<210> 121

<211> 2466

<212> DNA

<213> Streptococcus pneumoniae

<400> 121

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<210> 122

<211> 821

<212> PRT

<213> Streptococcus pneumoniae

<400> 122

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15

Gln Gln Lys Gln Lys Asn Lys Lys Ser Ala Arg Pro Gly Lys Lys Gly

20

25

30

Ser Ser Thr Lys Lys Ser Lys Thr Leu Asp Lys Ser Ala Ile Phe Pro

35

40

45

Ala Ile Leu Leu Ser Ile Lys Ala Leu Phe Asn Leu Leu Phe Val Leu
 50 55 60

Gly Phe Leu Gly Gly Met Leu Gly Ala Gly Ile Ala Leu Gly Tyr Gly
 65 70 75 80

Val Ala Leu Phe Asp Lys Val Arg Val Pro Gln Thr Glu Glu Leu Val
 85 90 95

Asn Gln Val Lys Asp Ile Ser Ser Ile Ser Glu Ile Thr Tyr Ser Asp
 100 105 110

Gly Thr Val Ile Ala Ser Ile Glu Ser Asp Leu Leu Arg Thr Ser Ile
 115 120 125

Ser Ser Glu Gln Ile Ser Glu Asn Leu Lys Lys Ala Ile Ile Ala Thr
 130 135 140

Glu Asp Glu His Phe Lys Glu His Lys Gly Val Val Pro Lys Ala Val
 145 150 155 160

Ile Arg Ala Thr Leu Gly Lys Phe Val Gly Leu Gly Ser Ser Ser Gly
 165 170 175

Gly Ser Thr Leu Thr Gln Gln Leu Ile Lys Gln Gln Val Val Gly Asp
 180 185 190

Ala Pro Thr Leu Ala Arg Lys Ala Ala Glu Ile Val Asp Ala Leu Ala
 195 200 205

Leu Glu Arg Ala Met Asn Lys Asp Glu Ile Leu Thr Thr Tyr Leu Asn
 210 215 220

Val Ala Pro Phe Gly Arg Asn Asn Lys Gly Gln Asn Ile Ala Gly Ala
 225 230 235 240

Arg Gln Ala Ala Glu Gly Ile Phe Gly Val Asp Ala Ser Gln Leu Thr
 245 250 255

Val Pro Gln Ala Ala Phe Leu Ala Gly Leu Pro Gln Ser Pro Ile Thr
 260 265 270

Tyr Ser Pro Tyr Glu Asn Thr Gly Glu Leu Lys Ser Asp Glu Asp Leu
 275 280 285

Glu Ile Gly Leu Arg Arg Ala Lys Ala Val Leu Tyr Ser Met Tyr Arg
 290 295 300

Thr Gly Ala Leu Ser Lys Asp Glu Tyr Ser Gln Tyr Lys Asp Tyr Asp
 305 310 315 320

Leu Lys Gln Asp Phe Leu Pro Ser Gly Thr Val Thr Gly Ile Ser Arg
 325 330 335

Asp Tyr Leu Tyr Phe Thr Thr Leu Ala Glu Ala Gln Glu Arg Met Tyr
 340 345 350

Asp Tyr Leu Ala Gln Arg Asp Asn Val Ser Ala Lys Glu Leu Lys Asn
 355 360 365

Glu Ala Thr Gln Lys Phe Tyr Arg Asp Leu Ala Ala Lys Glu Ile Glu
 370 375 380

Asn Gly Gly Tyr Lys Ile Thr Thr Thr Ile Asp Gln Lys Ile His Ser
 385 390 395 400

Ala Met Gln Ser Ala Val Ala Asp Tyr Gly Tyr Leu Leu Asp Asp Gly
 405 410 415

Thr Gly Arg Val Glu Val Gly Asn Val Leu Met Asp Asn Gln Thr Gly
 420 425 430

Ala Ile Leu Gly Phe Val Gly Gly Arg Asn Tyr Gln Glu Asn Gln Asn
 435 440 445

Asn His Ala Phe Asp Thr Lys Arg Ser Pro Ala Ser Thr Thr Lys Pro
 450 455 460

170

Leu Leu Ala Tyr Gly Ile Ala Ile Asp Gln Gly Leu Met Gly Ser Glu
465 470 475 480

Thr Ile Leu Ser Asn Tyr Pro Thr Asn Phe Ala Asn Gly Asn Pro Ile
485 490 495

Met Tyr Ala Asn Ser Lys Gly Thr Gly Met Met Thr Leu Gly Glu Ala
500 505 510

Leu Asn Tyr Ser Trp Asn Ile Pro Ala Tyr Trp Thr Tyr Arg Met Leu
515 520 525

Arg Glu Lys Gly Val Asp Val Lys Gly Tyr Met Glu Lys Met Gly Tyr
530 535 540

Glu Ile Pro Glu Tyr Gly Ile Glu Ser Leu Pro Met Gly Gly Gly Ile
545 550 555 560

Glu Val Thr Val Ala Gln His Thr Asn Gly Tyr Gln Thr Leu Ala Asn
565 570 575

Asn Gly Val Tyr His Gln Lys His Val Ile Ser Lys Ile Glu Ala Ala
580 585 590

Asp Gly Arg Val Val Tyr Glu Tyr Gln Asp Lys Pro Val Gln Val Tyr
595 600 605

Ser Lys Ala Thr Ala Thr Ile Met Gln Gly Leu Leu Arg Glu Val Leu
610 615 620

Ser Ser Arg Val Thr Thr Thr Phe Lys Ser Asn Leu Thr Ser Leu Asn
625 630 635 640

Pro Thr Leu Ala Asn Ala Asp Trp Ile Gly Lys Thr Gly Thr Thr Asn
645 650 655

Gln Asp Glu Asn Met Trp Leu Met Leu Ser Thr Pro Arg Leu Thr Leu
660 665 670

171

Gly Gly Trp Ile Gly His Asp Asp Asn His Ser Leu Ser Arg Arg Ala
675 680 685

Gly Tyr Ser Asn Asn Ser Asn Tyr Met Ala His Leu Val Asn Ala Ile
690 695 700

Gln Gln Ala Ser Pro Ser Ile Trp Gly Asn Glu Arg Phe Ala Leu Asp
705 710 715 720

Pro Ser Val Val Lys Ser Glu Val Leu Lys Ser Thr Gly Gln Lys Pro
725 730 735

Glu Lys Val Ser Val Glu Gly Lys Glu Val Glu Val Thr Gly Ser Thr
740 745 750

Val Thr Ser Tyr Trp Ala Asn Lys Ser Gly Ala Pro Ala Thr Ser Tyr
755 760 765

Arg Phe Ala Ile Gly Gly Ser Asp Ala Asp Tyr Gln Asn Ala Trp Ser
770 775 780

Ser Ile Val Gly Ser Leu Pro Thr Pro Ser Ser Ser Ser Ser Ser
785 790 795 800

Ser Ser Ser Ser Asp Ser Ser Asn Ser Ser Thr Thr Arg Pro Ser Ser
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Ser Arg Ala Arg Arg
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<210> 123

<211> 1974

<212> DNA

<213> Streptococcus pneumoniae

<400> 123

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<210> 124

<211> 657

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 124

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Leu Leu Thr Val Leu Ile Leu Phe Leu Phe Val Gly Gly Tyr Val Phe
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Leu Phe Lys Lys Leu Arg Val His Tyr Thr Arg Ser Asp Val Glu Gln
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Ile Gln Tyr Val Asn His Gln Ala Glu Glu Ser Leu Thr Ala Leu Leu
 65 70 75 80

Glu Gln Met Pro Val Gly Val Met Lys Leu Asn Leu Ser Ser Gly Glu
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Val Glu Trp Phe Asn Pro Tyr Ala Glu Leu Ile Leu Thr Lys Glu Asp
 100 105 110

Gly Asp Phe Asp Leu Glu Ala Val Gln Thr Ile Ile Lys Ala Ser Val
 115 120 125

Gly Asn Pro Ser Thr Tyr Ala Lys Leu Gly Glu Lys Arg Tyr Ala Val
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His Met Asp Ala Ser Ser Gly Val Leu Tyr Phe Val Asp Val Ser Arg
 145 150 155 160

Glu Gln Ala Ile Thr Asp Glu Leu Val Thr Ser Arg Pro Val Ile Gly
 165 170 175

Ile Val Ser Val Asp Asn Tyr Asp Asp Leu Glu Asp Glu Thr Ser Glu
 180 185 190

Ser Asp Ile Ser Gln Ile Asn Ser Phe Val Ala Asn Phe Ile Ser Glu
 195 200 205

Phe Ser Glu Lys His Met Met Phe Ser Arg Arg Val Ser Met Asp Arg
 210 215 220

Phe Tyr Leu Phe Thr Asp Tyr Thr Val Leu Glu Gly Leu Met Asn Asp
 225 230 235 240

Lys Phe Ser Val Ile Asp Ala Phe Arg Glu Glu Ser Lys Gln Arg Gln
 245 250 255

Leu Pro Leu Thr Leu Ser Met Gly Phe Ser Tyr Gly Asp Gly Asn His
 260 265 270

Asp Glu Ile Gly Lys Val Ala Leu Leu Asn Leu Asn Leu Ala Glu Val
 275 280 285

Arg Gly Gly Asp Gln Val Val Val Lys Glu Asn Asp Glu Thr Lys Asn
 290 295 300

Pro Val Tyr Phe Gly Gly Gly Ser Ala Ala Ser Ile Lys Arg Thr Arg
 305 310 315 320

Thr Arg Thr Arg Ala Met Met Thr Ala Ile Ser Asp Lys Ile Arg Ser
 325 330 335

Val Asp Gln Val Phe Val Val Gly His Lys Asn Leu Asp Met Asp Ala
 340 345 350

Leu Gly Ser Ala Val Gly Met Gln Leu Phe Ala Ser Asn Val Ile Glu
 355 360 365

Asn Ser Tyr Ala Leu Tyr Asp Glu Glu Gln Met Ser Pro Asp Ile Glu
 370 375 380

Arg Ala Val Ser Phe Ile Glu Lys Glu Gly Val Thr Lys Leu Leu Ser
 385 390 395 400

175

Val Lys Asp Ala Met Gly Met Val Thr Asn Arg Ser Leu Leu Ile Leu
405 410 415

Val Asp His Ser Lys Thr Ala Leu Thr Leu Ser Lys Glu Phe Tyr Asp
420 425 430

Leu Phe Thr Gln Thr Ile Val Ile Asp His His Arg Arg Asp Gln Asp
435 440 445

Phe Pro Asp Asn Ala Val Ile Thr Tyr Ile Glu Ser Gly Ala Ser Ser
450 455 460

Ala Ser Glu Leu Val Thr Glu Leu Ile Gln Phe Gln Asn Ser Lys Lys
465 470 475 480

Asn Arg Leu Ser Arg Met Gln Ala Ser Val Leu Met Ala Gly Met Met
485 490 495

Leu Asp Thr Lys Asn Phe Thr Ser Arg Val Thr Ser Arg Thr Phe Asp
500 505 510

Val Ala Ser Tyr Leu Arg Thr Arg Gly Ser Asp Ser Ile Ala Ile Gln
515 520 525

Glu Ile Ala Ala Thr Asp Phe Glu Glu Tyr Arg Glu Val Asn Glu Leu
530 535 540

Ile Leu Gln Gly Arg Lys Leu Gly Ser Asp Val Leu Ile Ala Glu Ala
545 550 555 560

Lys Asp Met Lys Cys Tyr Asp Thr Val Val Ile Ser Lys Ala Ala Asp
565 570 575

Ala Met Leu Ala Met Ser Gly Ile Glu Ala Ser Phe Val Leu Ala Lys
580 585 590

Asn Thr Gln Gly Phe Ile Ser Ile Ser Ala Arg Ser Arg Ser Lys Leu
595 600 605

Asn Val Gln Arg Ile Met Glu Glu Leu Gly Gly Gly Gly His Phe Asn
 610 615 620

Leu Ala Ala Ala Gln Ile Lys Asp Val Thr Leu Ser Glu Ala Gly Glu
 625 630 635 640

Lys Leu Thr Glu Ile Val Leu Asn Glu Met Lys Glu Lys Glu Lys Glu
 645 650 655

Glu

<210> 125

<211> 663

<212> DNA

<213> Streptococcus pneumoniae

<400> 125

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 ggggaagaga actgtccaaa ttgtatgaaa acagagttgt caacaaagtg tcaagattgt 180
 caactttggt gtaaagaggg agttgaagtc agtcatagag cgatttttac ttacaatcaa 240
 gctatgaagg attttttcag tcgggtataag tttgatggag acttctgtt aagaaaagtt 300
 ttgcgttcat ttttaagtga ggagttgaaa aagtacaaag agtatcaatt tgttgtaatt 360
 cccctaagtc ctgatagata tgctaataga ggatttaatc aggttgaggg cttggttagag 420
 gcagcaggct ttgagtatct ggatttatta gagaaaagag aagagagagc cagttcttct 480
 aaaaatcggt cagagcgctt ggggacagaa ctctcttctt ttattaaaag tggagtcact 540
 attcctaaaa aaatcctact tatagatgat atctatacta caggagcaac tataaatcgt 600
 gttaagaaac tgttggaaga agctgggtgct aaggatgtaa aaacattttc ccttgtaaga 660
 tga 663

<210> 126

<211> 220

<212> PRT

<213> Streptococcus pneumoniae

<400> 126

Met Lys Cys Leu Leu Cys Gly Gln Thr Met Lys Thr Val Leu Thr Phe
 1 5 10 15

Ser Ser Leu Leu Leu Leu Arg Asn Asp Asp Ser Cys Leu Cys Ser Asp
 20 25 30

Cys Asp Ser Thr Phe Glu Arg Ile Gly Glu Glu Asn Cys Pro Asn Cys
 35 40 45

Met Lys Thr Glu Leu Ser Thr Lys Cys Gln Asp Cys Gln Leu Trp Cys
 50 55 60

Lys Glu Gly Val Glu Val Ser His Arg Ala Ile Phe Thr Tyr Asn Gln
 65 70 75 80

Ala Met Lys Asp Phe Phe Ser Arg Tyr Lys Phe Asp Gly Asp Phe Leu
 85 90 95

Leu Arg Lys Val Phe Ala Ser Phe Leu Ser Glu Glu Leu Lys Lys Tyr
 100 105 110

Lys Glu Tyr Gln Phe Val Val Ile Pro Leu Ser Pro Asp Arg Tyr Ala
 115 120 125

Asn Arg Gly Phe Asn Gln Val Glu Gly Leu Val Glu Ala Ala Gly Phe
 130 135 140

Glu Tyr Leu Asp Leu Leu Glu Lys Arg Glu Glu Arg Ala Ser Ser Ser
 145 150 155 160

Lys Asn Arg Ser Glu Arg Leu Gly Thr Glu Leu Pro Phe Phe Ile Lys
 165 170 175

Ser Gly Val Thr Ile Pro Lys Lys Ile Leu Leu Ile Asp Asp Ile Tyr
 180 185 190

Thr Thr Gly Ala Thr Ile Asn Arg Val Lys Lys Leu Leu Glu Glu Ala
 195 200 205

Gly Ala Lys Asp Val Lys Thr Phe Ser Leu Val Arg
 210 215 220

<210> 127

<211> 1299

<212> DNA

<213> Streptococcus pneumoniae

<400> 127

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caacgctgta atagtactat tctagaagaa tggatatttgc ccatcgggtgc ttactattgt 180
cgagagtgtc tgctgatgaa gcgagtcaga agtgatcaaa ctttatacta ttttcgcgag 240
gaggattttc caaagcaaga tgttctcaaa tggcgcggcc aattaactcc ttttcaagag 300
aaggtgtcag agggattgtc tcaagtagta gacaagcaaa agccaacctt agttcatgcy 360
gtaacaggag ctggaaagac agaaatgatt tatcaagtag tggctaaagt gatcaatgcy 420
ggtggtgcag tgtgtttggc tagtcctcgc atagatgttt gtttggagct gtacaagcgc 480
ctgcaacagg atttttcttg cgggatagct ttgctacatg gagaatcgga accttatttt 540
cgaacaccac tagttgttgc aacaacccat cagttattga agttttatca agcttttgat 600
ttgctgatag tggatgaagt agatgctttt cttatgttg ataatoecat gctttaccac 660
gctgtcaaga atagtgtaaa ggagaatgga ttgagaatct ttttaacagc gacttcgacc 720
aatgagttag ataaaaaggt ccgttttaga gaactaaaaa gactgaattt accgagacgg 780
tttcatggaa atccgttgat tattccaaaa ccaatttggg tatcggattt taatcgctac 840
ttagacaaga atcgtttgtc accaaaagta aagtcctata ttgagaagca gagaaagaca 900
gcttatccgt tactcatttt tgcttcagaa attaagaaag gggagcagtt agcagaaatc 960
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ttggagcgcg gagttacctt cccttggtgtg gatgttttcg tagtagaggc caatcatcgt 1140
ttgtttacca agtctagttt gattcagatt ggtggacgag ttggacgaag catggataga 1200
ccgacaggag atttgctttt cttccatgat gggttaaatg cttcaatcaa gaaggcgatt 1260
aaggaaattc agatgatgaa taaggaggct ggtctatga 1299

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<210> 128

<211> 432

<212> PRT

<213> Streptococcus pneumoniae

<400> 128

Met Lys Val Asn Leu Asp Tyr Leu Gly Arg Leu Phe Thr Glu Asn Glu

1

5

10

15

Leu Thr Glu Glu Glu Arg Gln Leu Ala Glu Lys Leu Pro Ala Met Arg

20

25

30

Lys Glu Lys Gly Lys Leu Phe Cys Gln Arg Cys Asn Ser Thr Ile Leu

35

40

45

Glu Glu Trp Tyr Leu Pro Ile Gly Ala Tyr Tyr Cys Arg Glu Cys Leu

50

55

60

Leu Met Lys Arg Val Arg Ser Asp Gln Thr Leu Tyr Tyr Phe Pro Gln

65

70

75

80

Glu Asp Phe Pro Lys Gln Asp Val Leu Lys Trp Arg Gly Gln Leu Thr

85

90

95

Pro Phe Gln Glu Lys Val Ser Glu Gly Leu Leu Gln Val Val Asp Lys

100

105

110

Gln Lys Pro Thr Leu Val His Ala Val Thr Gly Ala Gly Lys Thr Glu

115

120

125

Met Ile Tyr Gln Val Val Ala Lys Val Ile Asn Ala Gly Gly Ala Val

130

135

140

Cys Leu Ala Ser Pro Arg Ile Asp Val Cys Leu Glu Leu Tyr Lys Arg

145

150

155

160

Leu Gln Gln Asp Phe Ser Cys Gly Ile Ala Leu Leu His Gly Glu Ser

165

170

175

180

Glu Pro Tyr Phe Arg Thr Pro Leu Val Val Ala Thr Thr His Gln Leu
180 185 190

Leu Lys Phe Tyr Gln Ala Phe Asp Leu Leu Ile Val Asp Glu Val Asp
195 200 205

Ala Phe Pro Tyr Val Asp Asn Pro Met Leu Tyr His Ala Val Lys Asn
210 215 220

Ser Val Lys Glu Asn Gly Leu Arg Ile Phe Leu Thr Ala Thr Ser Thr
225 230 235 240

Asn Glu Leu Asp Lys Lys Val Arg Leu Gly Glu Leu Lys Arg Leu Asn
245 250 255

Leu Pro Arg Arg Phe His Gly Asn Pro Leu Ile Ile Pro Lys Pro Ile
260 265 270

Trp Leu Ser Asp Phe Asn Arg Tyr Leu Asp Lys Asn Arg Leu Ser Pro
275 280 285

Lys Leu Lys Ser Tyr Ile Glu Lys Gln Arg Lys Thr Ala Tyr Pro Leu
290 295 300

Leu Ile Phe Ala Ser Glu Ile Lys Lys Gly Glu Gln Leu Ala Glu Ile
305 310 315 320

Leu Gln Glu Gln Phe Pro Asn Glu Lys Ile Gly Phe Val Ser Ser Val
325 330 335

Thr Glu Asp Arg Leu Glu Gln Val Gln Ala Phe Arg Asp Gly Glu Leu
340 345 350

Thr Ile Leu Ile Ser Thr Thr Ile Leu Glu Arg Gly Val Thr Phe Pro
355 360 365

Cys Val Asp Val Phe Val Val Glu Ala Asn His Arg Leu Phe Thr Lys
370 375 380

Ser Ser Leu Ile Gln Ile Gly Gly Arg Val Gly Arg Ser Met Asp Arg
 385 390 395 400

Pro Thr Gly Asp Leu Leu Phe Phe His Asp Gly Leu Asn Ala Ser Ile
 405 410 415

Lys Lys Ala Ile Lys Glu Ile Gln Met Met Asn Lys Glu Ala Gly Leu
 420 425 430

<210> 129

<211> 870

<212> DNA

<213> Streptococcus pneumoniae

<400> 129

atgcaaattc aaaaaagttt taaggggcag tctccctatg gcaagctgta tctagtggca 60
 acgccgattg gcaatctaga tgatatgact tttcgtgcta tccagacctt gaaagaagtg 120
 gactggattg ctgctgagga tacgcgcaat acagggtttt tgctcaagca ttttgacatt 180
 tccaccaagc agatcagttt tcatgagcac aatgccaaagg aaaaaattcc tgatttgatt 240
 ggttttcttga aagcagggca aagtattgct caggtctctg atgccggttt gcctagcatt 300
 tcagaccctg gtcattgatt agttaaggca gctattgagg aagaaattgc agttgtgaca 360
 gttccagggtg cctctgcagg aattttctgcc ttgattgcca gtggtttagc gccacagcca 420
 catatctttt acggtttttt accgagaaaa tcaggtcagc agaagcaatt ttttggttg 480
 aaaaaagatt atcctgaaac acagattttt tatgaatcac ctcatcgtgt agcagacacg 540
 ttggaaaata tgtagaagt ctacggtgac cgctccgttg tcttggtcag ggaattgacc 600
 aaaatctatg aagaatacca acgaggtact atctctgagt tattagaaag cattgctgaa 660
 acgccactca agggcgaatg tcttctcatt gttgaggggtg ccagtcaggg tgtggaggaa 720
 aaggacgagg aagacttggt cgtagaaatt caaaccgcga tccagcaagg tgtgaagaaa 780
 aaccaagcta tcaaggaagt cgctaagatt taccagtgga ataaaagtca gctctacgct 840
 gcctaccacg actggaaga aaaacaataa 870

<210> 130

<211> 289

<212> PRT

<213> Streptococcus pneumoniae

<400> 130

Met Gln Ile Gln Lys Ser Phe Lys Gly Gln Ser Pro Tyr Gly Lys Leu

1

5

10

15

Tyr Leu Val Ala Thr Pro Ile Gly Asn Leu Asp Asp Met Thr Phe Arg

20

25

30

Ala Ile Gln Thr Leu Lys Glu Val Asp Trp Ile Ala Ala Glu Asp Thr

35

40

45

Arg Asn Thr Gly Leu Leu Leu Lys His Phe Asp Ile Ser Thr Lys Gln

50

55

60

Ile Ser Phe His Glu His Asn Ala Lys Glu Lys Ile Pro Asp Leu Ile

65

70

75

80

Gly Phe Leu Lys Ala Gly Gln Ser Ile Ala Gln Val Ser Asp Ala Gly

85

90

95

Leu Pro Ser Ile Ser Asp Pro Gly His Asp Leu Val Lys Ala Ala Ile

100

105

110

Glu Glu Glu Ile Ala Val Val Thr Val Pro Gly Ala Ser Ala Gly Ile

115

120

125

Ser Ala Leu Ile Ala Ser Gly Leu Ala Pro Gln Pro His Ile Phe Tyr

130

135

140

Gly Phe Leu Pro Arg Lys Ser Gly Gln Gln Lys Gln Phe Phe Gly Leu

145

150

155

160

Lys Lys Asp Tyr Pro Glu Thr Gln Ile Phe Tyr Glu Ser Pro His Arg

165

170

175

183

Val Ala Asp Thr Leu Glu Asn Met Leu Glu Val Tyr Gly Asp Arg Ser
180 185 190

Val Val Leu Val Arg Glu Leu Thr Lys Ile Tyr Glu Glu Tyr Gln Arg
195 200 205

Gly Thr Ile Ser Glu Leu Leu Glu Ser Ile Ala Glu Thr Pro Leu Lys
210 215 220

Gly Glu Cys Leu Leu Ile Val Glu Gly Ala Ser Gln Gly Val Glu Glu
225 230 235 240

Lys Asp Glu Glu Asp Leu Phe Val Glu Ile Gln Thr Arg Ile Gln Gln
245 250 255

Gly Val Lys Lys Asn Gln Ala Ile Lys Glu Val Ala Lys Ile Tyr Gln
260 265 270

Trp Asn Lys Ser Gln Leu Tyr Ala Ala Tyr His Asp Trp Glu Glu Lys
275 280 285

Gln

<210> 131

<211> 345

<212> DNA

<213> Streptococcus pneumoniae

<400> 131

atgataaaga aaggaaaggg ctgttttatg gacaaaaaag aattatttga cgcgctggat 60
gatttttccc aacaattatt ggtaacctta gccgatgtgg aagccatcaa gaaaaatctc 120
aagagcctgg tagaggaaaa tacagctctt cgcttggaag atagtaagtt gcgagaacgc 180
ttgggtgagg tggaagcaga tgctcctgtc aaggccaagc atgttcgcga aagtgtccgt 240
cgtatttacc gtgatggatt tcacgtatgt aatgattttt atggacaacg tcgagagcag 300
gacgaagaat gtatgttttg tgacgagttg ttatacaggg agtaa 345

<210> 132

<211> 114

<212> PRT

<213> Streptococcus pneumoniae

<400> 132

Met Ile Lys Lys Gly Lys Gly Cys Phe Met Asp Lys Lys Glu Leu Phe

1

5

10

15

Asp Ala Leu Asp Asp Phe Ser Gln Gln Leu Leu Val Thr Leu Ala Asp

20

25

30

Val Glu Ala Ile Lys Lys Asn Leu Lys Ser Leu Val Glu Glu Asn Thr

35

40

45

Ala Leu Arg Leu Glu Asn Ser Lys Leu Arg Glu Arg Leu Gly Glu Val

50

55

60

Glu Ala Asp Ala Pro Val Lys Ala Lys His Val Arg Glu Ser Val Arg

65

70

75

80

Arg Ile Tyr Arg Asp Gly Phe His Val Cys Asn Asp Phe Tyr Gly Gln

85

90

95

Arg Arg Glu Gln Asp Glu Glu Cys Met Phe Cys Asp Glu Leu Leu Tyr

100

105

110

Arg Glu

<210> 133

<211> 639

<212> DNA

<213> Streptococcus pneumoniae

<400> 133

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atgtcaaaag gatttttagt ctctcttgag ggaccagagg gagcaggcaa gaccagtgtt 60
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cctggcggag tcttgattgg ggagaagatt cgggaagtga ttttgatcc aagtcatact 180
cagatggatg ctaaaacaga gctacttctc tatattgcca gtcgcagaca gcatttggtg 240
gaaaaagttc ttccagccct tgaagctggc aagtgggtca tcatggatcg ttttatcgat 300
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aatcagtttg cgacagatgg cctcaaaccg gatttgacac tctattttga catcgagggtg 420
gaagaagggc tggctcgtat tgctgctaag agtgaccgag aggttaatcg tttggatttg 480
gaagggttgg acttgcataa aaaagttcgt caaggctacc tttctcttct ggataaagag 540
ggaaatcgca ttgtcaagat tgatgctagt ctccctttgg agcaagttgt ggaaactacc 600
aaggctgtct tgtttgacgg aatgggcttg gccaaatga                               639

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<210> 134

<211> 212

<212> PRT

<213> Streptococcus pneumoniae

<400> 134

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Met Ser Lys Gly Phe Leu Val Ser Leu Glu Gly Pro Glu Gly Ala Gly
  1              5              10             15

```

```

Lys Thr Ser Val Leu Glu Ala Leu Leu Pro Ile Leu Glu Glu Lys Gly
      20              25             30

```

```

Val Glu Val Leu Thr Thr Arg Glu Pro Gly Gly Val Leu Ile Gly Glu
      35              40             45

```

```

Lys Ile Arg Glu Val Ile Leu Asp Pro Ser His Thr Gln Met Asp Ala
      50              55             60

```

```

Lys Thr Glu Leu Leu Leu Tyr Ile Ala Ser Arg Arg Gln His Leu Val
      65              70             75             80

```

```

Glu Lys Val Leu Pro Ala Leu Glu Ala Gly Lys Leu Val Ile Met Asp
      85              90             95

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186

Arg Phe Ile Asp Ser Ser Val Ala Tyr Gln Gly Phe Gly Arg Gly Leu
100 105 110

Asp Ile Glu Ala Ile Asp Trp Leu Asn Gln Phe Ala Thr Asp Gly Leu
115 120 125

Lys Pro Asp Leu Thr Leu Tyr Phe Asp Ile Glu Val Glu Glu Gly Leu
130 135 140

Ala Arg Ile Ala Ala Asn Ser Asp Arg Glu Val Asn Arg Leu Asp Leu
145 150 155 160

Glu Gly Leu Asp Leu His Lys Lys Val Arg Gln Gly Tyr Leu Ser Leu
165 170 175

Leu Asp Lys Glu Gly Asn Arg Ile Val Lys Ile Asp Ala Ser Leu Pro
180 185 190

Leu Glu Gln Val Val Glu Thr Thr Lys Ala Val Leu Phe Asp Gly Met
195 200 205

Gly Leu Ala Lys
210

<210> 135

<211> 474

<212> DNA

<213> Streptococcus pneumoniae

<400> 135

atggtagaac aaagaaaatc aattaccatg aaagatgttg ctttagaagc aggagttagt 60
gttggaactg ttccacgtgt aattaataaa gaaaaaggca ttaaagaagt aactttgaaa 120
aaagtggaac aagcgattaa aactttgaat tacattccag attactacgc tagaggaatg 180
aaaaaaaaatc gaacagaaac gattgcaatc attgtaccaa gtatctggca tccottcttt 240
tcagaatttg ctatgcatgt ggaaaatgaa gtctataaga gaaataacaa attactotta 300
tgttctatca atggtacaaa tagagagcaa gactatctgg agatgttgcg tcataataaa 360

gttgatggag tggttgccat tacctatagg ccaattgaac attacttgac gtcaggaatt 420
 ccctttgtta gtattgacog cacataactca gagattgcca ttccctgtgt ttca 474

<210> 136

<211> 158

<212> PRT

<213> Streptococcus pneumoniae

<400> 136

Met Val Glu Gln Arg Lys Ser Ile Thr Met Lys Asp Val Ala Leu Glu
 1 5 10 15

Ala Gly Val Ser Val Gly Thr Val Ser Arg Val Ile Asn Lys Glu Lys
 20 25 30

Gly Ile Lys Glu Val Thr Leu Lys Lys Val Glu Gln Ala Ile Lys Thr
 35 40 45

Leu Asn Tyr Ile Pro Asp Tyr Tyr Ala Arg Gly Met Lys Lys Asn Arg
 50 55 60

Thr Glu Thr Ile Ala Ile Ile Val Pro Ser Ile Trp His Pro Phe Phe
 65 70 75 80

Ser Glu Phe Ala Met His Val Glu Asn Glu Val Tyr Lys Arg Asn Asn
 85 90 95

Lys Leu Leu Leu Cys Ser Ile Asn Gly Thr Asn Arg Glu Gln Asp Tyr
 100 105 110

Leu Glu Met Leu Arg His Asn Lys Val Asp Gly Val Val Ala Ile Thr
 115 120 125

Tyr Arg Pro Ile Glu His Tyr Leu Thr Ser Gly Ile Pro Phe Val Ser
 130 135 140

Ile Asp Arg Thr Tyr Ser Glu Ile Ala Ile Pro Cys Val Ser
 145 150 155

<210> 137

<211> 374

<212> DNA

<213> Streptococcus pneumoniae

<400> 137

atgaatatat ttagaacaaa gaatgttagt ttagataaaa cagagatgca taggcatttg 60
 aagttatggg atttgatttt gctgggtatc ggagccatgg tagggacagg cgtctttaca 120
 atcacaggta ctgcagctgc aacacttgct ggcccagccc tagtgatttc aatcgttatt 180
 tctgccttgt gtgtgggatt atcagccctc ttttttgcag aatttgcctc gcgagtaccc 240
 gctacaggag gtgcctatag ttacctctat gctatcttag gagaattccc tgcctggttg 300
 gctggttggt taaccatgat ggagttcatg acagccatat caggcgtagc ttcgggttg 360
 gcagcttatt ttaa 374

<210> 138

<211> 124

<212> PRT

<213> Streptococcus pneumoniae

<400> 138

Met Asn Ile Phe Arg Thr Lys Asn Val Ser Leu Asp Lys Thr Glu Met
 1 5 10 15

His Arg His Leu Lys Leu Trp Asp Leu Ile Leu Leu Gly Ile Gly Ala
 20 25 30

Met Val Gly Thr Gly Val Phe Thr Ile Thr Gly Thr Ala Ala Ala Thr
 35 40 45

Leu Ala Gly Pro Ala Leu Val Ile Ser Ile Val Ile Ser Ala Leu Cys
 50 55 60

Val Gly Leu Ser Ala Leu Phe Phe Ala Glu Phe Ala Ser Arg Val Pro
 65 70 75 80

Ala Thr Gly Gly Ala Tyr Ser Tyr Leu Tyr Ala Ile Leu Gly Glu Phe
 85 90 95

Pro Ala Trp Leu Ala Gly Trp Leu Thr Met Met Glu Phe Met Thr Ala
 100 105 110

Ile Ser Gly Val Ala Ser Gly Trp Ala Ala Tyr Phe
 115 120

<210> 139

<211> 1311

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 139

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 gcgactattc tagcaagtga aggaaagacc gtcttgacaga atgttccgat tttgtcggat 180
 gtctttatta tgaatcaggt agttggtggt ttgaatgcc aagttgactt tgatgaggaa 240
 gctcatcttg tcaaggtgga tgctactggc gacatcactg aggaagcccc ttacaagtat 300
 gtcagcaaga tgcgcgcctc catcgttgta ttagggccaa tccttgcccg tgtgggtcat 360
 gccaaggtat ccatgccagg tggttgtacg attggttagcc gtcctattga tcttcatttg 420
 aaaggtcttg aagctatggg ggttaagatt agtcagacag ctggttacat cgaagccaag 480
 gcagaacgct tgcattggtg tcatatctat atggactttc caagtgttgg tgcaacgcag 540
 aacttgatga tggcagcgac tctggctgat ggggtgacag tgattgagaa tgctgcgcgt 600
 gagcctgaga ttgttgactt agccattctc cttaatgaaa tgggagccaa ggtcaaaggt 660
 gctggtacag agactataac cattactggt gttgagaaac ttcattggtac gactcacaat 720
 gtagtccaag accgtatcga agcaggaacc tttatggtag ctgctgccat gactggtggt 780
 gatgtcttga ttcgagacgc tgtctgggag cacaaccgtc ccttgattgc caagttactt 840
 gaaatgggtg ttgaagtaat tgaagaagac gaaggaattc gtgttcgttc tcaactagaa 900
 aatctaaaag ctgttcatgt gaaaaccttg cccacccag gatttccaac agatatgcag 960
 gctcaattta cagccttgat gacagttgca aaaggcgaat caaccatggt ggagacagtt 1020
 ttcgaaaatc gtttccaaca cctagaagag atgcgccgca tgggcttgca ttctgagatt 1080

atccgtgata cagctcgtat tggttggtgga cagcctttgc agggagcaga agttctttca 1140
 actgaccttc gtgccagtgc ggcottgatt ttgacagggt tggtagcaca gggagaaaact 1200
 gtggtcggta aattgggttca cttggataga gggtactacg gtttccatga gaagttggcg 1260
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<210> 140

<211> 436

<212> PRT

<213> Streptococcus pneumoniae

<400> 140

Met Lys Ser Arg Val Lys Glu Thr Ser Met Asp Lys Ile Val Val Gln

1 5 10 15

Gly Gly Asp Asn Arg Leu Val Gly Ser Val Thr Ile Glu Gly Ala Lys

20 25 30

Asn Ala Val Leu Pro Leu Leu Ala Ala Thr Ile Leu Ala Ser Glu Gly

35 40 45

Lys Thr Val Leu Gln Asn Val Pro Ile Leu Ser Asp Val Phe Ile Met

50 55 60

Asn Gln Val Val Gly Gly Leu Asn Ala Lys Val Asp Phe Asp Glu Glu

65 70 75 80

Ala His Leu Val Lys Val Asp Ala Thr Gly Asp Ile Thr Glu Glu Ala

85 90 95

Pro Tyr Lys Tyr Val Ser Lys Met Arg Ala Ser Ile Val Val Leu Gly

100 105 110

Pro Ile Leu Ala Arg Val Gly His Ala Lys Val Ser Met Pro Gly Gly

115 120 125

Cys Thr Ile Gly Ser Arg Pro Ile Asp Leu His Leu Lys Gly Leu Glu

130 135 140

191

Ala Met Gly Val Lys Ile Ser Gln Thr Ala Gly Tyr Ile Glu Ala Lys
145 150 155 160

Ala Glu Arg Leu His Gly Ala His Ile Tyr Met Asp Phe Pro Ser Val
165 170 175

Gly Ala Thr Gln Asn Leu Met Met Ala Ala Thr Leu Ala Asp Gly Val
180 185 190

Thr Val Ile Glu Asn Ala Ala Arg Glu Pro Glu Ile Val Asp Leu Ala
195 200 205

Ile Leu Leu Asn Glu Met Gly Ala Lys Val Lys Gly Ala Gly Thr Glu
210 215 220

Thr Ile Thr Ile Thr Gly Val Glu Lys Leu His Gly Thr Thr His Asn
225 230 235 240

Val Val Gln Asp Arg Ile Glu Ala Gly Thr Phe Met Val Ala Ala Ala
245 250 255

Met Thr Gly Gly Asp Val Leu Ile Arg Asp Ala Val Trp Glu His Asn
260 265 270

Arg Pro Leu Ile Ala Lys Leu Leu Glu Met Gly Val Glu Val Ile Glu
275 280 285

Glu Asp Glu Gly Ile Arg Val Arg Ser Gln Leu Glu Asn Leu Lys Ala
290 295 300

Val His Val Lys Thr Leu Pro His Pro Gly Phe Pro Thr Asp Met Gln
305 310 315 320

Ala Gln Phe Thr Ala Leu Met Thr Val Ala Lys Gly Glu Ser Thr Met
325 330 335

Val Glu Thr Val Phe Glu Asn Arg Phe Gln His Leu Glu Glu Met Arg
340 345 350

Arg Met Gly Leu His Ser Glu Ile Ile Arg Asp Thr Ala Arg Ile Val
 355 360 365

Gly Gly Gln Pro Leu Gln Gly Ala Glu Val Leu Ser Thr Asp Leu Arg
 370 375 380

Ala Ser Ala Ala Leu Ile Leu Thr Gly Leu Val Ala Gln Gly Glu Thr
 385 390 395 400

Val Val Gly Lys Leu Val His Leu Asp Arg Gly Tyr Tyr Gly Phe His
 405 410 415

Glu Lys Leu Ala Gln Leu Gly Ala Lys Ile Gln Arg Ile Glu Ala Ser
 420 425 430

Asp Glu Asp Glu
 435

<210> 141

<211> 1101

<212> DNA

<213> Streptococcus pneumoniae

<400> 141

atgttattag cgtcaacagt agccttgtca tttgccccag tattggcaac tcaagcagaa 60
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 aacaaaacaa gttataccgt acagtatggt gatactttga gcaccattgc agaagccttg 180
 ggtgtagatg tcacagtgct tgcgaatctg aacaaaatca ctaatatgga cttgattttc 240
 ccagaaaactg ttttgacaac gactgtcaat gaagcagaag aagtaacaga agttgaaatc 300
 caaacacctc aagcagactc tagtgaagaa gtgacaactg cgacagcaga tttgaccact 360
 aatcaagtga ccgttgatga tcaaactgtt caggttgacg acctttctca accaattgca 420
 gaagttacaa agacagtgat tgcttctgaa gaagtggcac catctacggg cacttctgtc 480
 ccagaggagc aaacgaccga aacaactcgc ccagttgcag aagaagctcc tcaggaaacg 540
 actccagctg agaagcagga aacacaaaca agcctcaag ctgcatcagc agtggaagca 600
 actacaacaa gttcagaagc aaaagaagta gcatcatcaa atggagctac agcagcagtt 660
 tctacttattc aaccagaaga aacgaaagta atttcaacaa cttacgaggc tccagctgcg 720

```

cccgattatg ctggacttgc agtagcaaaa tctgaaaatg caggtcttca accacaaaca 780
gctgccttta agaagaaatt gctaacttgt ttggcattac atcctttagt ggttatcgtc 840
caggagacag tggagatcac ggaaaagggt tggctatcga ctttatggta ccagaacgtt 900
cagaattagg ggataagatt gcggaatatg ctattcaaaa tatggccagc cgtggcatta 960
gttacatcat ctggaaacaa cgtttctatg ctccattcga tagcaaatat gggccagcta 1020
acacttggaa cccaatgcc aaccgtggta gtgtgacaga aaatcactat gatcacgttc 1080
acgtttcaat gaatggataa                                     1100

```

<210> 142

<211> 302

<212> PRT

<213> Streptococcus pneumoniae

<400> 142

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Met Leu Leu Ala Ser Thr Val Ala Leu Ser Phe Ala Pro Val Leu Ala
  1                   5                   10                  15

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Thr Gln Ala Glu Glu Val Leu Trp Thr Ala Arg Ser Val Glu Gln Ile
          20                   25                   30

```

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Gln Asn Asp Leu Thr Lys Thr Asp Asn Lys Thr Ser Tyr Thr Val Gln
          35                   40                   45

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```

Tyr Gly Asp Thr Leu Ser Thr Ile Ala Glu Ala Leu Gly Val Asp Val
          50                   55                   60

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```

Thr Val Leu Ala Asn Leu Asn Lys Ile Thr Asn Met Asp Leu Ile Phe
          65                   70                   75                   80

```

```

Pro Glu Thr Val Leu Thr Thr Thr Val Asn Glu Ala Glu Glu Val Thr
          85                   90                   95

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Glu Val Glu Ile Gln Thr Pro Gln Ala Asp Ser Ser Glu Glu Val Thr
          100                  105                  110

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```

Thr Ala Thr Ala Asp Leu Thr Thr Asn Gln Val Thr Val Asp Asp Gln
          115                  120                  125

```

194

Thr Val Gln Val Ala Asp Leu Ser Gln Pro Ile Ala Glu Val Thr Lys
130 135 140

Thr Val Ile Ala Ser Glu Glu Val Ala Pro Ser Thr Gly Thr Ser Val
145 150 155 160

Pro Glu Glu Gln Thr Thr Glu Thr Thr Arg Pro Val Ala Glu Glu Ala
165 170 175

Pro Gln Glu Thr Thr Pro Ala Glu Lys Gln Glu Thr Gln Thr Ser Pro
180 185 190

Gln Ala Ala Ser Ala Val Glu Ala Thr Thr Thr Ser Ser Glu Ala Lys
195 200 205

Glu Val Ala Ser Ser Asn Gly Ala Thr Ala Ala Val Ser Thr Tyr Gln
210 215 220

Pro Glu Glu Thr Lys Val Ile Ser Thr Thr Tyr Glu Ala Pro Ala Ala
225 230 235 240

Pro Asp Tyr Ala Gly Leu Ala Val Ala Lys Ser Glu Asn Ala Gly Leu
245 250 255

Gln Pro Gln Thr Ala Ala Phe Lys Lys Lys Leu Leu Thr Cys Leu Ala
260 265 270

Leu His Pro Leu Val Val Ile Val Gln Glu Thr Val Glu Ile Thr Glu
275 280 285

Lys Val Trp Leu Ser Thr Leu Trp Tyr Gln Asn Val Gln Asn
290 295 300

<210> 143

<211> 1281

<212> DNA

<213> Streptococcus pneumoniae

<400> 143

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ttgtttaaga aaaataaaga cattcttaat attgcattgc cagctatggg tgaaaacttt 60
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atttcagggg ttccagtagc tggtaatat atcaccattt atcaggcgat ttccatcgct 180
ctgggagctg ctatttccag tgttatttca aaaagcatag ggcagaaaga ccagtcgaag 240
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tttttgtcca tcttcgctgg gaaagagatg ataggacttt tggggacgga gagggatgta 360
gctgagagtg gtggactgta tctatctttg gtaggcggat cgattgttct cttaggttta 420
atgactagtc taggagcctt gattcgtgca acgcataatc cacgtctgcc tctctatgtt 480
agttttttat ccaatgcctt gaatatctt ttttcaagtc tagctatttt tgttctggat 540
atggggatag ctggtgttgc ttgggggaca atttgtgtct gtttggttgg tcttgtgatt 600
ttgtggtcac aattaaaact gccttatggg aagccaactt ttggttttaga taaggaaactg 660
ttgaccttgg ctttaccagc agctggagag cgacttatga tgagggctgg agatgtagtg 720
atcattgcct tggtcgtttc ttttgggacg gaggcagttg ctgggaatgc aatcggagaa 780
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ttttggcttt ctctgttctt catgttgccc ctgtccttta gtatatatgt cttgggtgta 960
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cagggattag gaaatgcacg cctccctttt tatgcgacaa gtataggaat gtggtgtatc 1140
cgcatggga caggatatct gatggggatt gtgcttggtt ggggcttgcc tggtatgttg 1200
gcagggtctc tcttgataa tggttttcgc tggttatttc tacgctatcg ttaccagcgc 1260
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```

<210> 144

<211> 426

<212> PRT

<213> Streptococcus pneumoniae

<400> 144

Leu Phe Lys Lys Asn Lys Asp Ile Leu Asn Ile Ala Leu Pro Ala Met

1

5

10

15

Gly Glu Asn Phe Leu Gln Met Leu Met Gly Met Val Asp Ser Tyr Leu
 20 25 30

Val Ala His Leu Gly Leu Ile Ala Ile Ser Gly Val Ser Val Ala Gly
 35 40 45

Asn Ile Ile Thr Ile Tyr Gln Ala Ile Phe Ile Ala Leu Gly Ala Ala
 50 55 60

Ile Ser Ser Val Ile Ser Lys Ser Ile Gly Gln Lys Asp Gln Ser Lys
 65 70 75 80

Leu Ala Tyr His Val Thr Glu Ala Leu Lys Ile Thr Leu Leu Leu Ser
 85 90 95

Phe Leu Leu Gly Phe Leu Ser Ile Phe Ala Gly Lys Glu Met Ile Gly
 100 105 110

Leu Leu Gly Thr Glu Arg Asp Val Ala Glu Ser Gly Gly Leu Tyr Leu
 115 120 125

Ser Leu Val Gly Gly Ser Ile Val Leu Leu Gly Leu Met Thr Ser Leu
 130 135 140

Gly Ala Leu Ile Arg Ala Thr His Asn Pro Arg Leu Pro Leu Tyr Val
 145 150 155 160

Ser Phe Leu Ser Asn Ala Leu Asn Ile Leu Phe Ser Ser Leu Ala Ile
 165 170 175

Phe Val Leu Asp Met Gly Ile Ala Gly Val Ala Trp Gly Thr Ile Val
 180 185 190

Ser Arg Leu Val Gly Leu Val Ile Leu Trp Ser Gln Leu Lys Leu Pro
 195 200 205

Tyr Gly Lys Pro Thr Phe Gly Leu Asp Lys Glu Leu Leu Thr Leu Ala
 210 215 220

197

Leu Pro Ala Ala Gly Glu Arg Leu Met Met Arg Ala Gly Asp Val Val
225 230 235 240

Ile Ile Ala Leu Val Val Ser Phe Gly Thr Glu Ala Val Ala Gly Asn
245 250 255

Ala Ile Gly Glu Val Leu Thr Gln Phe Asn Tyr Met Pro Ala Phe Gly
260 265 270

Val Ala Thr Ala Thr Val Met Leu Leu Ala Arg Ala Val Gly Glu Asp
275 280 285

Asp Trp Lys Arg Val Ala Ser Leu Ser Lys Gln Thr Phe Trp Leu Ser
290 295 300

Leu Phe Leu Met Leu Pro Leu Ser Phe Ser Ile Tyr Val Leu Gly Val
305 310 315 320

Pro Leu Thr His Leu Tyr Thr Thr Asp Ser Leu Ala Val Glu Ala Ser
325 330 335

Val Leu Val Thr Leu Phe Ser Leu Leu Gly Thr Pro Met Thr Thr Gly
340 345 350

Thr Val Ile Tyr Thr Ala Val Trp Gln Gly Leu Gly Asn Ala Arg Leu
355 360 365

Pro Phe Tyr Ala Thr Ser Ile Gly Met Trp Cys Ile Arg Ile Gly Thr
370 375 380

Gly Tyr Leu Met Gly Ile Val Leu Gly Trp Gly Leu Pro Gly Ile Trp
385 390 395 400

Ala Gly Ser Leu Leu Asp Asn Gly Phe Arg Trp Leu Phe Leu Arg Tyr
405 410 415

Arg Tyr Gln Arg Tyr Met Ser Leu Lys Gly
420 425

<210> 145

<211> 894

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 145

```

gtgggaagaa ttatcagagc aggtgtaaaag atggaacatc ttggaaaagt atttcgtgaa 60
tttogaacaa gtggaaatta ttcttttaaag gaagcagcag gcgaatcctg ctctacctct 120
cagttatctc gctttgagct tggggagctc gacctggcag totcccgttt ctttgagatt 180
ttggataaca ttcatgtaac aatcgaaaat ttcatggata aggcaaggaa ttttcataat 240
catgaacatg tgtctatgat ggcacagatt atcccacttt actattcaaa cgatattgca 300
ggttttcaaa agcttcaaag agaacaactt gaaaagtcta agagtctgac gactccccctt 360
tattttgagc tgaactggat tttgctacaa ggtctgattt gtcaaagaga tgcgagttat 420
gatatgaagc aggatgattt gggtaaggta gcagattatc tcttcaaaac agaagaatgg 480
accatgtatg agttgattct tttcggtaac ctctatagtt tctacgatgt agactatgtc 540
actcggattg gtagagaagt tatggagagg gaggaatttt accaagagat tagtcgccat 600
aagagattag tgttgatttt ggccctcaat tgttaccagc attgttttaga gcattcttct 660
ttttataatg ccaactattt tgaggcttat acagagaaga ttattgacaa aggtattaag 720
ctttatgagc gtaatgtttt ccattattta aaagggtttg ctttatatca aaaaggacag 780
tgtaagaag gctgtaagca gatgcaagag gccatgcata tttttgatgt gttaggtctt 840
ccagagcaag tagcctatta tcaggaacac tacgaaaaat ttgtcaaaag ttaa      894

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<210> 146

<211> 297

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 146

```

Val Gly Arg Ile Ile Arg Ala Gly Val Lys Met Glu His Leu Gly Lys
  1                   5                   10                   15

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```

Val Phe Arg Glu Phe Arg Thr Ser Gly Asn Tyr Ser Leu Lys Glu Ala
      20                   25                   30

```

Ala Gly Glu Ser Cys Ser Thr Ser Gln Leu Ser Arg Phe Glu Leu Gly
 35 40 45

Glu Ser Asp Leu Ala Val Ser Arg Phe Phe Glu Ile Leu Asp Asn Ile
 50 55 60

His Val Thr Ile Glu Asn Phe Met Asp Lys Ala Arg Asn Phe His Asn
 65 70 75 80

His Glu His Val Ser Met Met Ala Gln Ile Ile Pro Leu Tyr Tyr Ser
 85 90 95

Asn Asp Ile Ala Gly Phe Gln Lys Leu Gln Arg Glu Gln Leu Glu Lys
 100 105 110

Ser Lys Ser Ser Thr Thr Pro Leu Tyr Phe Glu Leu Asn Trp Ile Leu
 115 120 125

Leu Gln Gly Leu Ile Cys Gln Arg Asp Ala Ser Tyr Asp Met Lys Gln
 130 135 140

Asp Asp Leu Gly Lys Val Ala Asp Tyr Leu Phe Lys Thr Glu Glu Trp
 145 150 155 160

Thr Met Tyr Glu Leu Ile Leu Phe Gly Asn Leu Tyr Ser Phe Tyr Asp
 165 170 175

Val Asp Tyr Val Thr Arg Ile Gly Arg Glu Val Met Glu Arg Glu Glu
 180 185 190

Phe Tyr Gln Glu Ile Ser Arg His Lys Arg Leu Val Leu Ile Leu Ala
 195 200 205

Leu Asn Cys Tyr Gln His Cys Leu Glu His Ser Ser Phe Tyr Asn Ala
 210 215 220

Asn Tyr Phe Glu Ala Tyr Thr Glu Lys Ile Ile Asp Lys Gly Ile Lys
 225 230 235 240

200

Leu Tyr Glu Arg Asn Val Phe His Tyr Leu Lys Gly Phe Ala Leu Tyr
245 250 255

Gln Lys Gly Gln Cys Lys Glu Gly Cys Lys Gln Met Gln Glu Ala Met
260 265 270

His Ile Phe Asp Val Leu Gly Leu Pro Glu Gln Val Ala Tyr Tyr Gln
275 280 285

Glu His Tyr Glu Lys Phe Val Lys Ser
290 295

<210> 147

<211> 1068

<212> DNA

<213> Streptococcus pneumoniae

<400> 147

atgtctaaca ttcaaaacat gtccctggag gacatcatgg gagagcgctt tggtcgctac 60
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cagcgccgta ttctttattc tatgaataag gatagcaata cttttgacaa gagctaccgt 180
aagtcggcca agtcagtcgg gaacatcatg gggaatttcc acccacacgg ggattcttct 240
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tttgcatgga actttgacga tacggagaaa gaaccaacgg tcttgccagc agcctttcca 480
aacctcttgg tcaatggttc gactgggatt tcggctgggt atgccacaga cattcctccc 540
cataatthag ctgaggtcat agatgctgca gtttacatga ttgaccacc aactgcaaag 600
attgataaac tcatggaatt cttgcctgga ccagacttcc ctacaggggc tattattcag 660
ggtcgtgatg aaatcaagaa agcttatgag actgggaaaag ggcgcgtggt tgttcgttcc 720
aagactgaaa ttgaaaagct aaaagggtgg aaggaacaaa tcgttattat tgagattcct 780
tatgaaatca ataaggccaa tctagtcaag aaaatcgatg atgttcgtgt taataacaag 840
gtagctggga ttgctgaggt tcgtgatgag tctgaccgtg atggtcttcg tctcgtatc 900
gaacttaaga aagacgctaa tactgagctt gttctcaact acttatttaa gtacaccgac 960
ctacaaatca actacaactt taatatggtg gcgattgaca atttcacacc tcgtcagggt 1020
ggattgttcc aatcctgtct agctatatcg ctcaccgtcg agaagtga 1068

<210> 148

<211> 355

<212> PRT

<213> Streptococcus pneumoniae

<400> 148

Met Ser Asn Ile Gln Asn Met Ser Leu Glu Asp Ile Met Gly Glu Arg

1

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10

15

Phe Gly Arg Tyr Ser Lys Tyr Ile Ile Gln Asp Arg Ala Leu Pro Asp

20

25

30

Ile Arg Asp Gly Leu Lys Pro Val Gln Arg Arg Ile Leu Tyr Ser Met

35

40

45

Asn Lys Asp Ser Asn Thr Phe Asp Lys Ser Tyr Arg Lys Ser Ala Lys

50

55

60

Ser Val Gly Asn Ile Met Gly Asn Phe His Pro His Gly Asp Ser Ser

65

70

75

80

Ile Tyr Asp Ala Met Val Arg Met Ser Gln Asn Trp Lys Asn Arg Glu

85

90

95

Ile Leu Val Glu Met His Gly Asn Asn Gly Ser Met Asp Gly Asp Pro

100

105

110

Pro Ala Ala Met Arg Tyr Thr Glu Ala Arg Leu Ser Glu Ile Ala Gly

115

120

125

Tyr Leu Leu Gln Asp Ile Glu Lys Lys Thr Val Pro Phe Ala Trp Asn

130

135

140

Phe Asp Asp Thr Glu Lys Glu Pro Thr Val Leu Pro Ala Ala Phe Pro

145

150

155

160

202

Asn Leu Leu Val Asn Gly Ser Thr Gly Ile Ser Ala Gly Tyr Ala Thr
165 170 175

Asp Ile Pro Pro His Asn Leu Ala Glu Val Ile Asp Ala Ala Val Tyr
180 185 190

Met Ile Asp His Pro Thr Ala Lys Ile Asp Lys Leu Met Glu Phe Leu
195 200 205

Pro Gly Pro Asp Phe Pro Thr Gly Ala Ile Ile Gln Gly Arg Asp Glu
210 215 220

Ile Lys Lys Ala Tyr Glu Thr Gly Lys Gly Arg Val Val Val Arg Ser
225 230 235 240

Lys Thr Glu Ile Glu Lys Leu Lys Gly Gly Lys Glu Gln Ile Val Ile
245 250 255

Ile Glu Ile Pro Tyr Glu Ile Asn Lys Ala Asn Leu Val Lys Lys Ile
260 265 270

Asp Asp Val Arg Val Asn Asn Lys Val Ala Gly Ile Ala Glu Val Arg
275 280 285

Asp Glu Ser Asp Arg Asp Gly Leu Arg Ile Ala Ile Glu Leu Lys Lys
290 295 300

Asp Ala Asn Thr Glu Leu Val Leu Asn Tyr Leu Phe Lys Tyr Thr Asp
305 310 315 320

Leu Gln Ile Asn Tyr Asn Phe Asn Met Val Ala Ile Asp Asn Phe Thr
325 330 335

Pro Arg Gln Val Gly Leu Phe Gln Ser Cys Leu Ala Ile Ser Leu Thr
340 345 350

Val Glu Lys
355

<210> 149

<211> 684

<212> DNA

<213> Streptococcus pneumoniae

<400> 149

```

atgccgacat tagaaatagc aaaaaaaaaa ctggagttca ttaagaaggc agaagaatat 60
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acttctgtta accctgggga aggaaaaaca actacttcca taaatatagc atggtcggtt 180
gcgcggtgcag gctataaaac tcttttgatc gatggcgata ctcgaaattc agttatgtta 240
ggagttttta aatctcgtga aaaaattaca gggctaacag aatttttatc tgggacagct 300
gatttatctc acggtttatg tgatacaaat attgaaaatt tatttgtagt tcaatcggga 360
tctgtatcac caaacctac agccttgta caaagtaaaa attttaatga tatgattgaa 420
acattgcgta aatatgttga ttatatcatt attgatacac cgcctattgg aattgttatt 480
gatgcggcaa ttatcactca aaagtgtgat gcgtccatct tggtaacagc aacaggtgag 540
gcgaataaac gtgatatcca aaaagcgaaa caacaattaa aacaaacagg gaaactgttc 600
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tatggaaatt atggtaaaaa ataa                                     684

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<210> 150

<211> 227

<212> PRT

<213> Streptococcus pneumoniae

<400> 150

Met Pro Thr Leu Glu Ile Ala Gln Lys Lys Leu Glu Phe Ile Lys Lys

1

5

10

15

Ala Glu Glu Tyr Tyr Asn Ala Leu Cys Thr Asn Ile Gln Leu Ser Gly

20

25

30

Asp Lys Leu Lys Val Ile Ser Val Thr Ser Val Asn Pro Gly Glu Gly

35

40

45

Lys Thr Thr Thr Ser Ile Asn Ile Ala Trp Ser Phe Ala Arg Ala Gly
 50 55 60

Tyr Lys Thr Leu Leu Ile Asp Gly Asp Thr Arg Asn Ser Val Met Leu
 65 70 75 80

Gly Val Phe Lys Ser Arg Glu Lys Ile Thr Gly Leu Thr Glu Phe Leu
 85 90 95

Ser Gly Thr Ala Asp Leu Ser His Gly Leu Cys Asp Thr Asn Ile Glu
 100 105 110

Asn Leu Phe Val Val Gln Ser Gly Ser Val Ser Pro Asn Pro Thr Ala
 115 120 125

Leu Leu Gln Ser Lys Asn Phe Asn Asp Met Ile Glu Thr Leu Arg Lys
 130 135 140

Tyr Phe Asp Tyr Ile Ile Ile Asp Thr Pro Pro Ile Gly Ile Val Ile
 145 150 155 160

Asp Ala Ala Ile Ile Thr Gln Lys Cys Asp Ala Ser Ile Leu Val Thr
 165 170 175

Ala Thr Gly Glu Ala Asn Lys Arg Asp Ile Gln Lys Ala Lys Gln Gln
 180 185 190

Leu Lys Gln Thr Gly Lys Leu Phe Leu Gly Val Val Leu Asn Lys Leu
 195 200 205

Asp Ile Ser Val Asn Lys Tyr Gly Val Tyr Gly Ser Tyr Gly Asn Tyr
 210 215 220

Gly Lys Lys
 225

<210> 151

<211> 1194

<212> DNA

<213> Streptococcus pneumoniae

<400> 151

```

atggaggcaa atatgaaaca tctaaaaaca ttttacaaaa aatgggtttca attattagtc 60
gttatcgta ttagcttttt tagtggagcc ttgggtagtt tttcaataac tcaactaact 120
caaaaaagta gtgtaaacaa ctctaacaac aatagtacta ttacacaaac tgcctataag 180
aacgaaaatt caacaacaca ggctgttaac aaagtaaaag atgctgttgt ttctgttatt 240
acttattcgg caaacagaca aaatagcgta tttggcaatg atgatactga cacagattct 300
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gggactaaag tacctggaga aattgtcgga gctgacactt tctctgatat tgctgtcgtc 480
aaaatctctt cagaaaaagt gacaacagta gctgagtttg gtgattctag taagttaact 540
gtaggagaaa ctgctattgc catcggtagc ccggttaggt ctgaatatgc aaatactgtc 600
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ccactgatca atattcaagg gcagggtatc ggaattacct caagtaaaat tgctacaaat 780
ggaggaacat ctgtagaagg tcttggtttc gcaattcctg caaatgatgc tatcaatatt 840
attgaacagt tagaaaaaaa cggaaaagtg acgcgtccag ctttgggaat ccagatgggt 900
aatttatcta atgtgagtac aagcgacatc agaagactca atattccaag taatgttaca 960
totggtgtaa ttgttcgttc ggtacaaagt aatatgootg ccaatggtca ccttgaaaaa 1020
tacgatgtaa ttacaaaagt agatgacaaa gagattgott catcaacaga cttacaaagt 1080
gctctttaca accattctat cggagacacc attaagataa cctactatcg taacgggaaa 1140
gaagaaacta cctctatcaa acttaacaag agttcaggtg atttagaato ttaa      1194

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<210> 152

<211> 397

<212> PRT

<213> Streptococcus pneumoniae

<400> 152

Met Glu Ala Asn Met Lys His Leu Lys Thr Phe Tyr Lys Lys Trp Phe

1

5

10

15

Gln Leu Leu Val Val Ile Val Ile Ser Phe Phe Ser Gly Ala Leu Gly
 20 25 30

Ser Phe Ser Ile Thr Gln Leu Thr Gln Lys Ser Ser Val Asn Asn Ser
 35 40 45

Asn Asn Asn Ser Thr Ile Thr Gln Thr Ala Tyr Lys Asn Glu Asn Ser
 50 55 60

Thr Thr Gln Ala Val Asn Lys Val Lys Asp Ala Val Val Ser Val Ile
 65 70 75 80

Thr Tyr Ser Ala Asn Arg Gln Asn Ser Val Phe Gly Asn Asp Asp Thr
 85 90 95

Asp Thr Asp Ser Gln Arg Ile Ser Ser Glu Gly Ser Gly Val Ile Tyr
 100 105 110

Lys Lys Asn Asp Lys Glu Ala Tyr Ile Val Thr Asn Asn His Val Ile
 115 120 125

Asn Gly Ala Ser Lys Val Asp Ile Arg Leu Ser Asp Gly Thr Lys Val
 130 135 140

Pro Gly Glu Ile Val Gly Ala Asp Thr Phe Ser Asp Ile Ala Val Val
 145 150 155 160

Lys Ile Ser Ser Glu Lys Val Thr Thr Val Ala Glu Phe Gly Asp Ser
 165 170 175

Ser Lys Leu Thr Val Gly Glu Thr Ala Ile Ala Ile Gly Ser Pro Leu
 180 185 190

Gly Ser Glu Tyr Ala Asn Thr Val Thr Gln Gly Ile Val Ser Ser Leu
 195 200 205

Asn Arg Asn Val Ser Leu Lys Ser Glu Asp Gly Gln Ala Ile Ser Thr
 210 215 220

207

Lys Ala Ile Gln Thr Asp Thr Ala Ile Asn Pro Gly Asn Ser Gly Gly
225 230 235 240

Pro Leu Ile Asn Ile Gln Gly Gln Val Ile Gly Ile Thr Ser Ser Lys
245 250 255

Ile Ala Thr Asn Gly Gly Thr Ser Val Glu Gly Leu Gly Phe Ala Ile
260 265 270

Pro Ala Asn Asp Ala Ile Asn Ile Ile Glu Gln Leu Glu Lys Asn Gly
275 280 285

Lys Val Thr Arg Pro Ala Leu Gly Ile Gln Met Val Asn Leu Ser Asn
290 295 300

Val Ser Thr Ser Asp Ile Arg Arg Leu Asn Ile Pro Ser Asn Val Thr
305 310 315 320

Ser Gly Val Ile Val Arg Ser Val Gln Ser Asn Met Pro Ala Asn Gly
325 330 335

His Leu Glu Lys Tyr Asp Val Ile Thr Lys Val Asp Asp Lys Glu Ile
340 345 350

Ala Ser Ser Thr Asp Leu Gln Ser Ala Leu Tyr Asn His Ser Ile Gly
355 360 365

Asp Thr Ile Lys Ile Thr Tyr Tyr Arg Asn Gly Lys Glu Glu Thr Thr
370 375 380

Ser Ile Lys Leu Asn Lys Ser Ser Gly Asp Leu Glu Ser
385 390 395

<210> 153

<211> 939

<212> DNA

<213> Streptococcus pneumoniae

<400> 153

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atggcagaaa tttatctagc aggtggttgt ttttggggcc tagaggaata tttttcacgc 60
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taccagttgc tcaaggaaac agaccatgca gaaacgggtcc aagtgattta cgatgagaag 180
gaagtgtcac tcagagagat tttactttat tttttccgag ttatcgatcc tctatctatc 240
aatcaacaag ggaatgaccg tggtcgccaa tatcgaaactg ggatttatta tcaggatgaa 300
gcagatttgc cagctatcta cacagtgggtg caggagcagg aacgcatgct gggtcgaaaag 360
attgcagtag aagtggagca attacgccac tacattctgg ctgaagacta ccaccaagac 420
tatctcagga agaatccttc aggttactgt catatcgatg tgaccgatgc tgataagcca 480
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gaccaaactt ttgaagaggg gatttatgta gatattacga caggtgagcc actctttttt 660
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<210> 154

<211> 312

<212> PRT

<213> Streptococcus pneumoniae

<400> 154

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Met Ala Glu Ile Tyr Leu Ala Gly Gly Cys Phe Trp Gly Leu Glu Glu
  1             5             10             15

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Tyr Phe Ser Arg Ile Ser Gly Val Leu Glu Thr Ser Val Gly Tyr Ala
      20             25             30

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Asn Gly Gln Val Glu Thr Thr Asn Tyr Gln Leu Leu Lys Glu Thr Asp
      35             40             45

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His Ala Glu Thr Val Gln Val Ile Tyr Asp Glu Lys Glu Val Ser Leu
 50 55 60

Arg Glu Ile Leu Leu Tyr Tyr Phe Arg Val Ile Asp Pro Leu Ser Ile
 65 70 75 80

Asn Gln Gln Gly Asn Asp Arg Gly Arg Gln Tyr Arg Thr Gly Ile Tyr
 85 90 95

Tyr Gln Asp Glu Ala Asp Leu Pro Ala Ile Tyr Thr Val Val Gln Glu
 100 105 110

Gln Glu Arg Met Leu Gly Arg Lys Ile Ala Val Glu Val Glu Gln Leu
 115 120 125

Arg His Tyr Ile Leu Ala Glu Asp Tyr His Gln Asp Tyr Leu Arg Lys
 130 135 140

Asn Pro Ser Gly Tyr Cys His Ile Asp Val Thr Asp Ala Asp Lys Pro
 145 150 155 160

Leu Ile Asp Ala Ala Asn Tyr Glu Lys Pro Ser Gln Glu Val Leu Lys
 165 170 175

Ala Ser Leu Ser Glu Glu Ser Tyr Arg Val Thr Gln Glu Ala Ala Thr
 180 185 190

Glu Ala Pro Phe Thr Asn Ala Tyr Asp Gln Thr Phe Glu Glu Gly Ile
 195 200 205

Tyr Val Asp Ile Thr Thr Gly Glu Pro Leu Phe Phe Ala Lys Asp Lys
 210 215 220

Phe Ala Ser Gly Cys Gly Trp Pro Ser Phe Ser Arg Pro Ile Ser Lys
 225 230 235 240

Glu Leu Ile His Tyr Tyr Lys Asp Leu Ser His Gly Met Glu Arg Ile
 245 250 255

210

Glu Val Arg Ser Arg Ser Gly Ser Ala His Leu Gly His Val Phe Thr
260 265 270

Asp Gly Pro Arg Glu Leu Gly Gly Leu Arg Tyr Cys Ile Asn Ser Ala
275 280 285

Ser Leu Arg Phe Val Ala Lys Asp Glu Met Glu Lys Ala Gly Tyr Gly
290 295 300

Tyr Leu Leu Pro Tyr Leu Asn Lys
305 310

<210> 155

<211> 870

<212> DNA

<213> Streptococcus pneumoniae

<400> 155

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gaacaccaga ttggcaaattg gattccacat gacgagcgta atctcttgct caaaatcgct 180
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gaagctgttg ctgcaagttc tatcgccaat gtagcgggtg ctgccttggt ggcaggagac 600
atggtgaccg ctgggcaagc aatcgaggga gacctcttcc atgagcgcta tcgtcaggac 660
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tacctttctg gtgctggggc gacagttatg gttctggctt ctcatgacaa gatgccaaca 780
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acccaagggtg tccgtgtaga agcaaaaataa 870

<210> 156

<211> 289

<212> PRT

<213> Streptococcus pneumoniae

<400> 156

Met Lys Ile Ile Val Pro Ala Thr Ser Ala Asn Ile Gly Pro Gly Phe

1

5

10

15

Asp Ser Val Gly Val Ala Val Thr Lys Tyr Leu Gln Ile Glu Val Cys

20

25

30

Glu Glu Arg Asp Glu Trp Leu Ile Glu His Gln Ile Gly Lys Trp Ile

35

40

45

Pro His Asp Glu Arg Asn Leu Leu Leu Lys Ile Ala Leu Gln Ile Val

50

55

60

Pro Asp Leu Gln Pro Arg Arg Leu Lys Met Thr Ser Asp Val Pro Leu

65

70

75

80

Ala Arg Gly Leu Gly Ser Ser Ser Ser Val Ile Val Ala Gly Ile Glu

85

90

95

Leu Ala Asn Gln Leu Gly Gln Leu Asn Leu Ser Asp His Glu Lys Leu

100

105

110

Gln Leu Ala Thr Lys Ile Glu Gly His Pro Asp Asn Val Ala Pro Ala

115

120

125

Ile Tyr Gly Asn Leu Val Ile Ala Ser Ser Val Glu Gly Gln Val Ser

130

135

140

Ala Ile Val Ala Asp Phe Pro Glu Cys Asp Phe Leu Ala Tyr Ile Pro

145

150

155

160

Asn Tyr Glu Leu Arg Thr Arg Asp Ser Arg Ser Val Leu Pro Lys Lys

165

170

175

212

Leu Ser Tyr Lys Glu Ala Val Ala Ala Ser Ser Ile Ala Asn Val Ala
180 185 190

Val Ala Ala Leu Leu Ala Gly Asp Met Val Thr Ala Gly Gln Ala Ile
195 200 205

Glu Gly Asp Leu Phe His Glu Arg Tyr Arg Gln Asp Leu Val Arg Glu
210 215 220

Phe Ala Met Ile Lys Gln Val Thr Lys Glu Asn Gly Ala Tyr Ala Thr
225 230 235 240

Tyr Leu Ser Gly Ala Gly Pro Thr Val Met Val Leu Ala Ser His Asp
245 250 255

Lys Met Pro Thr Ile Lys Ala Glu Leu Glu Lys Gln Pro Phe Lys Gly
260 265 270

Lys Leu His Asp Leu Arg Val Asp Thr Gln Gly Val Arg Val Glu Ala
275 280 285

Lys

<210> 157

<211> 564

<212> DNA

<213> Streptococcus pneumoniae

<400> 157

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gtctatcaag ctttaaaggt ttctactcct ttgctgattg agacattcgc tcccaattta 180
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 ctttatttttaa gagaaaaagta tcagattagc tctgggtcttg tcattgggtga tcggccgatt 480
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 ttaagacaag tattagacat ataa 564

<210> 158

<211> 187

<212> PRT

<213> Streptococcus pneumoniae

<400> 158

Met Lys Tyr His Asp Tyr Ile Trp Asp Leu Gly Gly Thr Leu Leu Asp

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Asn Tyr Glu Thr Ser Thr Ala Ala Phe Val Glu Thr Leu Ala Leu Tyr

20 25 30

Gly Ile Thr Gln Asp His Asp Ser Val Tyr Gln Ala Leu Lys Val Ser

35 40 45

Thr Pro Phe Ala Ile Glu Thr Phe Ala Pro Asn Leu Glu Asn Phe Leu

50 55 60

Glu Lys Tyr Lys Glu Asn Glu Ala Arg Glu Leu Glu His Pro Ile Leu

65 70 75 80

Phe Glu Gly Val Ser Asp Leu Leu Glu Asp Ile Ser Asn Gln Gly Gly

85 90 95

Arg His Phe Leu Val Ser His Arg Asn Asp Gln Val Leu Glu Ile Leu

100 105 110

Glu Lys Thr Ser Ile Ala Ala Tyr Phe Thr Glu Val Val Thr Ser Ser

115 120 125

Ser Gly Phe Lys Arg Lys Pro Asn Pro Glu Ser Met Leu Tyr Leu Arg

130 135 140

Glu Lys Tyr Gln Ile Ser Ser Gly Leu Val Ile Gly Asp Arg Pro Ile
 145 150 155 160

Asp Ile Glu Ala Gly Gln Ala Ala Gly Leu Asp Thr His Leu Phe Thr
 165 170 175

Ser Ile Val Asn Leu Arg Gln Val Leu Asp Ile
 180 185

<210> 159

<211> 1875

<212> DNA

<213> Streptococcus pneumoniae

<400> 159

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 ggatttgcca gccatattca agtttttatt gagccagatg attcgattac tgttgtggat 240
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 ttggcctttc taaatcgcg tcttcaaatt tcaattacag ataagcgcca aggttttgaa 660
 caaaccaagc attatcatta tgaaggtggg attgctagtt acgttgaata tatcaacgag 720
 aacaaggatg taatctttga tacaccaatc tatacagacg gtgagatgga tgatatacaca 780
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<210> 160

<211> 624

<212> PRT

<213> Streptococcus pneumoniae

<400> 160

Met Thr Glu Glu Ile Lys Asn Leu Gln Ala Gln Asp Tyr Asp Ala Ser
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Gln Ile Gln Val Leu Glu Gly Leu Glu Ala Val Arg Met Arg Pro Gly
 20 25 30

Met Tyr Ile Gly Ser Thr Ser Lys Glu Gly Leu His His Leu Val Trp
 35 40 45

Glu Ile Val Asp Asn Ser Ile Asp Glu Ala Leu Ala Gly Phe Ala Ser
 50 55 60

His Ile Gln Val Phe Ile Glu Pro Asp Asp Ser Ile Thr Val Val Asp
 65 70 75 80

Asp Gly Arg Gly Ile Pro Val Asp Ile Gln Glu Lys Thr Gly Arg Pro
 85 90 95

216

Ala Val Glu Thr Val Phe Thr Val Leu His Ala Gly Gly Lys Phe Gly
100 105 110

Gly Gly Gly Tyr Lys Val Ser Gly Gly Leu His Gly Val Gly Ser Ser
115 120 125

Val Val Asn Ala Leu Ser Thr Gln Leu Asp Val His Val His Lys Asn
130 135 140

Gly Lys Ile His Tyr Gln Glu Tyr Arg Arg Gly His Val Val Ala Asp
145 150 155 160

Leu Glu Ile Val Gly Asp Thr Asp Lys Thr Gly Thr Thr Val His Phe
165 170 175

Thr Pro Asp Pro Lys Ile Phe Thr Glu Thr Thr Ile Phe Asp Phe Asp
180 185 190

Lys Leu Asn Lys Arg Ile Gln Glu Leu Ala Phe Leu Asn Arg Gly Leu
195 200 205

Gln Ile Ser Ile Thr Asp Lys Arg Gln Gly Leu Glu Gln Thr Lys His
210 215 220

Tyr His Tyr Glu Gly Gly Ile Ala Ser Tyr Val Glu Tyr Ile Asn Glu
225 230 235 240

Asn Lys Asp Val Ile Phe Asp Thr Pro Ile Tyr Thr Asp Gly Glu Met
245 250 255

Asp Asp Ile Thr Val Glu Val Ala Met Gln Tyr Thr Thr Gly Tyr His
260 265 270

Glu Asn Val Met Ser Phe Ala Asn Asn Ile His Thr His Glu Gly Gly
275 280 285

Thr His Glu Gln Gly Phe Arg Thr Ala Leu Thr Arg Val Ile Asn Asp
290 295 300

[illegible]

Arg Tyr Gln Lys Leu Val Leu Met Thr Asp Ala Asp Val Asp Gly Ala
500 505 510

His Ile Arg Thr Leu Leu Leu Thr Leu Ile Tyr Arg Tyr Met Lys Pro
 515 520 525

Ile Leu Glu Ala Gly Tyr Val Tyr Ile Ala Gln Pro Pro Ile Tyr Gly
 530 535 540

Val Lys Val Gly Ser Glu Ile Lys Glu Tyr Ile Gln Pro Gly Ala Asp
 545 550 555 560

Gln Glu Ile Lys Leu Gln Glu Ala Leu Ala Arg Tyr Ser Glu Gly Arg
 565 570 575

Thr Lys Pro Thr Ile Gln Arg Tyr Lys Gly Leu Gly Glu Met Asp Asp
 580 585 590

His Gln Leu Trp Glu Thr Thr Met Asp Pro Glu His Arg Leu Met Ala
 595 600 605

Arg Val Ser Val Asp Asp Val Gln Lys Gln Ile Lys Ser Leu Ile Cys
 610 615 620

<210> 161

<211> 1446

<212> DNA

<213> Streptococcus pneumoniae

<400> 161

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 gtagggctac tcttgattat ctataaaaaa gctgaaaagt ttactatctt tctgttggtg 240
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 aatcggttaa atgcgacttc taattactca gaatattcaa tcagtgtcgc tgttttagca 360

gatagtgaga tcgaaaatgt tacgcaactg acgagtgatga cagcaccgac tgggactaat 420
aatgaaaata ttcagaaatt actagctgat atcaagtcaa gtcagaatac cgatttgacg 480
gtcaaccaga gttcgtctta cttggcagct tacaagagtt tgattgcagg ggagactaag 540
gccattgtcc taaatagtgt ctttgaaaac atcatcgagt cagagtatcc agactacgca 600
tcgaagataa aaaagattta tactaaggga ttcactaaaa aagtagaagc tcctaagacg 660
tctaagagtc agtctttcaa tatctatggt agtggaattg acacctatgg tcctattagt 720
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agatga 1446

<210> 162

<211> 481

<212> PRT

<213> *Streptococcus pneumoniae*

<400> 162

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20 25 30

Leu Phe Leu Ile Phe Lys Tyr Asn Ile Leu Ala Phe Arg Tyr Leu Asn
35 40 45

Leu Val Val Thr Ala Leu Val Leu Leu Val Ala Leu Val Gly Leu Leu
50 55 60

[illegible]

Thr Lys Lys Ile Leu Leu Thr Thr Thr Pro Arg Asp Ala Tyr Val Pro
260 265 270

Ile Ala Asp Gly Gly Asn Asn Gln Lys Asp Lys Leu Thr His Ala Gly
 275 280 285

Ile Tyr Gly Val Asp Ser Ser Ile His Thr Leu Glu Asn Leu Tyr Gly
 290 295 300

Val Asp Ile Asn Tyr Tyr Val Arg Leu Asn Phe Thr Ser Phe Leu Lys
 305 310 315 320

Leu Ile Asp Leu Leu Gly Gly Ile Asp Val Tyr Asn Asp Gln Glu Phe
 325 330 335

Thr Ala His Thr Asn Gly Lys Tyr Tyr Pro Ala Gly Asn Val His Leu
 340 345 350

Asp Ser Glu Gln Ala Leu Gly Phe Val Arg Glu Arg Tyr Ser Leu Ala
 355 360 365

Asp Gly Asp Arg Asp Arg Gly Arg His Gln Gln Lys Val Ile Val Ala
 370 375 380

Ile Leu Gln Lys Leu Thr Ser Thr Glu Val Leu Lys Asn Tyr Ser Thr
 385 390 395 400

Ile Ile Asn Ser Leu Gln Asp Ser Ile Gln Thr Asn Met Pro Leu Glu
 405 410 415

Thr Met Ile Asn Leu Val Asn Ala Gln Leu Glu Ser Gly Gly Asn Tyr
 420 425 430

Lys Val Asn Ser Gln Asp Leu Lys Gly Thr Gly Arg Met Asp Leu Pro
 435 440 445

Ser Tyr Ala Met Pro Asp Ser Asn Leu Tyr Val Met Glu Ile Asp Asp
 450 455 460

Ser Ser Leu Ala Val Val Lys Ala Ala Ile Gln Asp Val Met Glu Gly
 465 470 475 480

Arg

<210> 163

<211> 732

<212> DNA

<213> Streptococcus pneumoniae

<400> 163

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cacaatctag acggtagacc tcotcatatg gcagaagcat atgaccttgt taccGaaaaa 660
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732

<210> 164

<211> 243

<212> PRT

<213> Streptococcus pneumoniae

<400> 164

Met Ile Asp Ile His Ser His Ile Val Phe Asp Val Asp Asp Gly Pro

1

5

10

15

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20

25

30

Gly Val Arg Thr Ile Val Ser Thr Ser His Arg Arg Lys Gly Met Phe
 35 40 45

Glu Thr Pro Glu Glu Lys Ile Ala Glu Asn Phe Leu Gln Val Arg Glu
 50 55 60

Ile Ala Lys Glu Val Ala Ser Asp Leu Val Ile Ala Tyr Gly Ala Glu
 65 70 75 80

Ile Tyr Tyr Thr Pro Asp Val Leu Asp Lys Leu Glu Lys Lys Arg Ile
 85 90 95

Pro Thr Leu Asn Asp Ser Arg Tyr Ala Leu Ile Glu Phe Ser Met Asn
 100 105 110

Thr Pro Tyr Arg Asp Ile His Ser Ala Leu Ser Lys Ile Leu Met Leu
 115 120 125

Gly Ile Thr Pro Val Ile Ala His Ile Glu Arg Tyr Asp Ala Leu Glu
 130 135 140

Asn Asn Glu Lys Arg Val Arg Glu Leu Ile Asp Met Gly Cys Tyr Thr
 145 150 155 160

Gln Val Asn Ser Ser His Val Leu Lys Pro Lys Leu Phe Gly Glu Arg
 165 170 175

Tyr Lys Phe Met Lys Lys Arg Ala Gln Tyr Phe Leu Glu Gln Asp Leu
 180 185 190

Val His Val Ile Ala Ser Asp Met His Asn Leu Asp Gly Arg Pro Pro
 195 200 205

His Met Ala Glu Ala Tyr Asp Leu Val Thr Gln Lys Tyr Gly Glu Ala
 210 215 220

Lys Ala Gln Glu Leu Phe Ile Asp Asn Pro Arg Lys Ile Val Met Asp
 225 230 235 240

Gln Leu Ile

<210> 165

<211> 3990

<212> DNA

<213> *Streptococcus pneumoniae*

<400> 165

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 aaccgtttata ctgcagaaaag cgtcacggcc gtaaaaagaag ctgaaaaaagc tattcgctct 1800
 ctcgatagca accttagccg tgcccaacaa gatacgattg atcaagccat tgctaaactt 1860
 caagaaactg tcaacaactt gacctcacg cctgaagctc aaaaagaaga agaagctaaa 1920
 cgtgaggttg aaaaacttgc caaaaacaag gtaatctcaa tcgatgctgg acgcaaatac 1980
 tttactctga accagctcaa acgcacgta gacaaggcca gtgagctcgg atattctgat 2040
 gtccatctcc ttctaggaag tgacggactt cgctttctac tcgatgatat gaccattact 2100
 gccaacggaa aaacctatgc tagtgatgac gttaaaaaag ctattatcga aggaactaaa 2160
 gcttactacg acgatccaaa cggtagtgca ctaacacagg cagaagtaac agagctaatt 2220
 gaatacgtca aatctaagga catcggtctc atcccagcta ttaacagtcc aggtcacatg 2280
 gatgctatgc tgggtgccat ggaaaaatta ggtattaaaa atcctcaagc ccactttgat 2340
 aaagtttcaa aaacaactat ggacttgaag aacgaagaag cgatgaactt tgtaaaagcc 2400
 ctcatcggtg aatacatgga cttctttgca ggtaaaacaa agattttcaa ctttgggtact 2460
 gacgaatacg ccaacgatgc gactagtgcc caaggctggt actacctcaa gtggtatcaa 2520
 ctctatggca aatttgccga atatgccaac accctcgag ctatggccaa agaaagaggg 2580
 cttcaaccaa tggccttcaa cgatggcttc tactatgaag acaaggacga tgttcagttt 2640
 gacaaagatg tcttgatttc ttactggtct aaaggctggt ggggatataa cctcgcatca 2700
 cctcaatacc tagcaagcaa aggctataaa ttcttgaata ccaacggtga ctggtactac 2760
 attcttggtc aaaaaccaga agatggtggt ggtttcctca agaaagctat tgagaataact 2820
 ggaaaaacac cattcaatca actagcttct accaaatatc ctgaagtaga tcttccaaca 2880
 gtcggaagta tgctttcaat ctgggcagat agaccaagcg ctgaatacaa ggaagaggaa 2940
 atctttgaac tcatgactgc ctttgcagac cacaacaaag actactttcg tgctaattat 3000
 aatgctctcc gcgaagaatt agctaaaatt cctacaaact tagaaggata tagtaaagaa 3060
 agtcttgagg cccttgacgc agctaaaaca gctctaaatt acaacctcaa ccgtaataaa 3120
 caagctgagc ttgacacgct ttagccaac ctaaaagccg ctottcaagg cctcaaacca 3180
 gctgtaactc attcaggaag cctagatgaa aatgaagtgg ctgccaatgt tgaaaccaga 3240
 ccagaactca tcacaagaac tgaagaaatt ccatttgaag ttatcaagaa agaaaatcct 3300
 aacctccag ccggtcagga aaatattatc acagcaggag tcaaagggtga acgaactcat 3360
 tacatctctg tactcactga aaatggaaaa acaacagaaa cagtcttga tagccaggta 3420
 accaaagaag ttataaacca agtggttgaa gttggcgctc ctgtaactca caaggggtgat 3480
 gaaagtggtc ttgcaccaac tactgaggta aaacctagac tggatatcca agaagaagaa 3540
 attccattta ccacagtgc ttgtgaaaat ccactcttac tcaaaggaaa aacacaagtc 3600
 attactaagg gcgtcaatgg acatcgtagc aacttctact ctgtgagcac ttctgccgat 3660
 ggtaagggaag tgaaaacact tgtaaatagt gtcgtagcac aggaagccgt tactcaaata 3720
 gtcgaagtcg gaactatggt aacacatgta ggcgatgaaa acggacaagc cgctattgct 3780
 gaagaaaaaac caaaactaga aatcccaagc caaccagctc catcaactgc tctgctgag 3840
 gaaagcaaag ttcttctca agatccagct cctgtggtaa cagagaaaaa acttctgaa 3900

acaggaactc acgattctgc aggactagta gtcgcaggac tcatgtccac actagcagcc 3960
 tatggactca ctaaaagaaa agaagactaa 3990

<210> 166

<211> 1329

<212> PRT

<213> Streptococcus pneumoniae

<400> 166

Met Ile Tyr Ile Ile Ala Ile Asn Ile Thr Met Gln Ser Gly Gly Phe
 1 5 10 15

Ala Met Lys His Glu Lys Gln Gln Arg Phe Ser Ile Arg Lys Tyr Ala
 20 25 30

Val Gly Ala Ala Ser Val Leu Ile Gly Phe Ala Phe Gln Ala Gln Thr
 35 40 45

Val Ala Ala Asp Gly Val Thr Pro Thr Thr Thr Glu Asn Gln Pro Thr
 50 55 60

Ile His Thr Val Ser Asp Ser Pro Gln Ser Ser Glu Asn Arg Thr Glu
 65 70 75 80

Glu Thr Pro Lys Ala Val Leu Gln Pro Glu Ala Pro Lys Thr Val Glu
 85 90 95

Thr Glu Thr Pro Ala Thr Asp Lys Val Ala Ser Leu Pro Lys Thr Glu
 100 105 110

Glu Lys Pro Gln Glu Glu Val Ser Ser Thr Pro Ser Asp Lys Ala Glu
 115 120 125

Val Val Thr Pro Thr Ser Ala Glu Lys Glu Thr Ala Asn Lys Lys Ala
 130 135 140

227

Glu Glu Ala Ser Pro Lys Lys Glu Glu Ala Lys Glu Val Asp Ser Lys
145 150 155 160

Glu Ser Asn Thr Asp Lys Thr Asp Lys Asp Lys Pro Ala Lys Lys Asp
165 170 175

Glu Ala Lys Ala Glu Ala Asp Lys Pro Ala Thr Glu Ala Gly Lys Glu
180 185 190

Arg Ala Ala Thr Val Asn Glu Lys Leu Ala Lys Lys Lys Ile Val Ser
195 200 205

Ile Asp Ala Gly Arg Lys Tyr Phe Ser Pro Glu Gln Leu Lys Glu Ile
210 215 220

Ile Asp Lys Ala Lys His Tyr Gly Tyr Thr Asp Leu His Leu Leu Val
225 230 235 240

Gly Asn Asp Gly Leu Arg Phe Met Leu Asp Asp Met Ser Ile Thr Ala
245 250 255

Asn Gly Lys Thr Tyr Ala Ser Asp Asp Val Lys Arg Ala Ile Glu Lys
260 265 270

Gly Thr Asn Asp Tyr Tyr Asn Asp Pro Asn Gly Asn His Leu Thr Glu
275 280 285

Ser Gln Met Thr Asp Leu Ile Asn Tyr Ala Lys Asp Lys Gly Ile Gly
290 295 300

Leu Ile Pro Thr Val Asn Ser Pro Gly His Met Asp Ala Ile Leu Asn
305 310 315 320

Ala Met Lys Glu Leu Gly Ile Gln Asn Pro Asn Phe Ser Tyr Phe Gly
325 330 335

Lys Lys Ser Ala Arg Thr Val Asp Leu Asp Asn Glu Gln Ala Val Ala
340 345 350

Phe Thr Lys Ala Leu Ile Asp Lys Tyr Ala Ala Tyr Phe Ala Lys Lys
 355 360 365

Thr Glu Ile Phe Asn Ile Gly Leu Asp Glu Tyr Ala Asn Asp Ala Thr
 370 375 380

Asp Ala Lys Gly Trp Ser Val Leu Gln Ala Asp Lys Tyr Tyr Pro Asn
 385 390 395 400

Glu Gly Tyr Pro Val Lys Gly Tyr Glu Lys Phe Ile Ala Tyr Ala Asn
 405 410 415

Asp Leu Ala Arg Ile Val Lys Ser His Gly Leu Lys Pro Met Ala Phe
 420 425 430

Asn Asp Gly Ile Tyr Tyr Asn Ser Asp Thr Ser Phe Gly Ser Phe Asp
 435 440 445

Lys Asp Ile Ile Val Ser Met Trp Thr Gly Gly Trp Gly Gly Tyr Asp
 450 455 460

Val Ala Ser Ser Lys Leu Leu Ala Glu Lys Gly His Gln Ile Leu Asn
 465 470 475 480

Thr Asn Asp Ala Trp Tyr Tyr Val Leu Gly Arg Asn Ala Asp Gly Gln
 485 490 495

Gly Trp Tyr Asn Leu Asp Gln Gly Leu Asn Gly Ile Lys Asn Thr Pro
 500 505 510

Ile Thr Ser Val Pro Lys Thr Glu Gly Ala Asp Ile Pro Ile Ile Gly
 515 520 525

Gly Met Val Ala Ala Trp Ala Asp Thr Pro Ser Ala Arg Tyr Ser Pro
 530 535 540

Ser Arg Leu Phe Lys Leu Met Arg His Phe Ala Asn Ala Asn Ala Glu
 545 550 555 560

229

Tyr Phe Ala Ala Asp Tyr Glu Ser Ala Glu Gln Ala Leu Asn Glu Val
565 570 575

Pro Lys Asp Leu Asn Arg Tyr Thr Ala Glu Ser Val Thr Ala Val Lys
580 585 590

Glu Ala Glu Lys Ala Ile Arg Ser Leu Asp Ser Asn Leu Ser Arg Ala
595 600 605

Gln Gln Asp Thr Ile Asp Gln Ala Ile Ala Lys Leu Gln Glu Thr Val
610 615 620

Asn Asn Leu Thr Leu Thr Pro Glu Ala Gln Lys Glu Glu Glu Ala Lys
625 630 635 640

Arg Glu Val Glu Lys Leu Ala Lys Asn Lys Val Ile Ser Ile Asp Ala
645 650 655

Gly Arg Lys Tyr Phe Thr Leu Asn Gln Leu Lys Arg Ile Val Asp Lys
660 665 670

Ala Ser Glu Leu Gly Tyr Ser Asp Val His Leu Leu Leu Gly Asn Asp
675 680 685

Gly Leu Arg Phe Leu Leu Asp Asp Met Thr Ile Thr Ala Asn Gly Lys
690 695 700

Thr Tyr Ala Ser Asp Asp Val Lys Lys Ala Ile Ile Glu Gly Thr Lys
705 710 715 720

Ala Tyr Tyr Asp Asp Pro Asn Gly Thr Ala Leu Thr Gln Ala Glu Val
725 730 735

Thr Glu Leu Ile Glu Tyr Ala Lys Ser Lys Asp Ile Gly Leu Ile Pro
740 745 750

Ala Ile Asn Ser Pro Gly His Met Asp Ala Met Leu Val Ala Met Glu
755 760 765

Lys Leu Gly Ile Lys Asn Pro Gln Ala His Phe Asp Lys Val Ser Lys
 770 775 780

Thr Thr Met Asp Leu Lys Asn Glu Glu Ala Met Asn Phe Val Lys Ala
 785 790 795 800

Leu Ile Gly Lys Tyr Met Asp Phe Phe Ala Gly Lys Thr Lys Ile Phe
 805 810 815

Asn Phe Gly Thr Asp Glu Tyr Ala Asn Asp Ala Thr Ser Ala Gln Gly
 820 825 830

Trp Tyr Tyr Leu Lys Trp Tyr Gln Leu Tyr Gly Lys Phe Ala Glu Tyr
 835 840 845

Ala Asn Thr Leu Ala Ala Met Ala Lys Glu Arg Gly Leu Gln Pro Met
 850 855 860

Ala Phe Asn Asp Gly Phe Tyr Tyr Glu Asp Lys Asp Asp Val Gln Phe
 865 870 875 880

Asp Lys Asp Val Leu Ile Ser Tyr Trp Ser Lys Gly Trp Trp Gly Tyr
 885 890 895

Asn Leu Ala Ser Pro Gln Tyr Leu Ala Ser Lys Gly Tyr Lys Phe Leu
 900 905 910

Asn Thr Asn Gly Asp Trp Tyr Tyr Ile Leu Gly Gln Lys Pro Glu Asp
 915 920 925

Gly Gly Gly Phe Leu Lys Lys Ala Ile Glu Asn Thr Gly Lys Thr Pro
 930 935 940

Phe Asn Gln Leu Ala Ser Thr Lys Tyr Pro Glu Val Asp Leu Pro Thr
 945 950 955 960

Val Gly Ser Met Leu Ser Ile Trp Ala Asp Arg Pro Ser Ala Glu Tyr
 965 970 975

Lys Glu Glu Glu Ile Phe Glu Leu Met Thr Ala Phe Ala Asp His Asn
 980 985 990

Lys Asp Tyr Phe Arg Ala Asn Tyr Asn Ala Leu Arg Glu Glu Leu Ala
 995 1000 1005

Lys Ile Pro Thr Asn Leu Glu Gly Tyr Ser Lys Glu Ser Leu Glu Ala
 1010 1015 1020

Leu Asp Ala Ala Lys Thr Ala Leu Asn Tyr Asn Leu Asn Arg Asn Lys
 1025 1030 1035 1040

Gln Ala Glu Leu Asp Thr Leu Val Ala Asn Leu Lys Ala Ala Leu Gln
 1045 1050 1055

Gly Leu Lys Pro Ala Val Thr His Ser Gly Ser Leu Asp Glu Asn Glu
 1060 1065 1070

Val Ala Ala Asn Val Glu Thr Arg Pro Glu Leu Ile Thr Arg Thr Glu
 1075 1080 1085

Glu Ile Pro Phe Glu Val Ile Lys Lys Glu Asn Pro Asn Leu Pro Ala
 1090 1095 1100

Gly Gln Glu Asn Ile Ile Thr Ala Gly Val Lys Gly Glu Arg Thr His
 1105 1110 1115 1120

Tyr Ile Ser Val Leu Thr Glu Asn Gly Lys Thr Thr Glu Thr Val Leu
 1125 1130 1135

Asp Ser Gln Val Thr Lys Glu Val Ile Asn Gln Val Val Glu Val Gly
 1140 1145 1150

Ala Pro Val Thr His Lys Gly Asp Glu Ser Gly Leu Ala Pro Thr Thr
 1155 1160 1165

Glu Val Lys Pro Arg Leu Asp Ile Gln Glu Glu Glu Ile Pro Phe Thr
 1170 1175 1180

232

Thr Val Thr Cys Glu Asn Pro Leu Leu Leu Lys Gly Lys Thr Gln Val
1185 1190 1195 1200

Ile Thr Lys Gly Val Asn Gly His Arg Ser Asn Phe Tyr Ser Val Ser
1205 1210 1215

Thr Ser Ala Asp Gly Lys Glu Val Lys Thr Leu Val Asn Ser Val Val
1220 1225 1230

Ala Gln Glu Ala Val Thr Gln Ile Val Glu Val Gly Thr Met Val Thr
1235 1240 1245

His Val Gly Asp Glu Asn Gly Gln Ala Ala Ile Ala Glu Glu Lys Pro
1250 1255 1260

Lys Leu Glu Ile Pro Ser Gln Pro Ala Pro Ser Thr Ala Pro Ala Glu
1265 1270 1275 1280

Glu Ser Lys Val Leu Pro Gln Asp Pro Ala Pro Val Val Thr Glu Lys
1285 1290 1295

Lys Leu Pro Glu Thr Gly Thr His Asp Ser Ala Gly Leu Val Val Ala
1300 1305 1310

Gly Leu Met Ser Thr Leu Ala Ala Tyr Gly Leu Thr Lys Arg Lys Glu
1315 1320 1325

Asp

<210> 167

<211> 825

<212> DNA

<213> Streptococcus pneumoniae

<400> 167

atgaacaaaa aaacaagaca gacactaatc ggactgctag tggtattgct tttgtctaca 60
gggagctatt atatcaagca gatgcgctog gcacctaata gtcccaaaac caatcttagt 120
cagaaaaaac aagcgtctga agctoctagt caagcattgg cagagagtgt cttaacagac 180

gcagtcaaga gtcaaataaa ggggagtcctg gaggtggaatg gctcaggtgc ttttatcgtc 240
aatggtaata aaacaaatct agatgccaaag gtttcaagta agccctacgc tgacaataaa 300
acaaagacag tgggcaagga aactgttcca accgtagcta atgccctctt gtctaaggcc 360
actcgtcagt acaagaatcg taaagaaact gggaatgggt caacttcttg gactcctcca 420
ggttggcatc aggtcaagaa tctaaagggc tcttataccc atgcagtcga tagaggtcac 480
ttgttaggct atgccttaat cgggtggtttg gatgggtttg atgcctcaac aagcaatcct 540
aaaaacattg ctgttcagac agcctgggca aatcaggcac aagccgagta ttcgactggc 600
caaaactact atgaaagcaa ggtgcgtaaa gccttggacc aaaacaagcg tgtccgttac 660
cgtgtaaccc tttactacgc ttcaaagcag gatttagttc cctcagcttc acagattgaa 720
gccaagtctt cggatggaga attggaattc aatgttctag ttcccaatgt tcaaaagggg 780
cttcaactgg attaccgaac tggagaagta actgtaactc agtaa 825

<210> 168

<211> 274

<212> PRT

<213> Streptococcus pneumoniae

<400> 168

Met Asn Lys Lys Thr Arg Gln Thr Leu Ile Gly Leu Leu Val Leu Leu
1 5 10 15

Leu Leu Ser Thr Gly Ser Tyr Tyr Ile Lys Gln Met Pro Ser Ala Pro
20 25 30

Asn Ser Pro Lys Thr Asn Leu Ser Gln Lys Lys Gln Ala Ser Glu Ala
35 40 45

Pro Ser Gln Ala Leu Ala Glu Ser Val Leu Thr Asp Ala Val Lys Ser
50 55 60

Gln Ile Lys Gly Ser Leu Glu Trp Asn Gly Ser Gly Ala Phe Ile Val
65 70 75 80

Asn Gly Asn Lys Thr Asn Leu Asp Ala Lys Val Ser Ser Lys Pro Tyr
85 90 95

Ala Asp Asn Lys Thr Lys Thr Val Gly Lys Glu Thr Val Pro Thr Val
 100 105 110

Ala Asn Ala Leu Leu Ser Lys Ala Thr Arg Gln Tyr Lys Asn Arg Lys
 115 120 125

Glu Thr Gly Asn Gly Ser Thr Ser Trp Thr Pro Pro Gly Trp His Gln
 130 135 140

Val Lys Asn Leu Lys Gly Ser Tyr Thr His Ala Val Asp Arg Gly His
 145 150 155 160

Leu Leu Gly Tyr Ala Leu Ile Gly Gly Leu Asp Gly Phe Asp Ala Ser
 165 170 175

Thr Ser Asn Pro Lys Asn Ile Ala Val Gln Thr Ala Trp Ala Asn Gln
 180 185 190

Ala Gln Ala Glu Tyr Ser Thr Gly Gln Asn Tyr Tyr Glu Ser Lys Val
 195 200 205

Arg Lys Ala Leu Asp Gln Asn Lys Arg Val Arg Tyr Arg Val Thr Leu
 210 215 220

Tyr Tyr Ala Ser Asn Glu Asp Leu Val Pro Ser Ala Ser Gln Ile Glu
 225 230 235 240

Ala Lys Ser Ser Asp Gly Glu Leu Glu Phe Asn Val Leu Val Pro Asn
 245 250 255

Val Gln Lys Gly Leu Gln Leu Asp Tyr Arg Thr Gly Glu Val Thr Val
 260 265 270

Thr Gln

<210> 169

<211> 225

<212> DNA

<213> Streptococcus pneumoniae

<400> 169

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gtgctaagat tcagcggatt gaggcaagtg atgaagatga ataagaaatc aagctacgta 60
gtcaagcggt tacttttagt catcatagta ctgatttttag gtactctggc tctaggaatc 120
ggtttaaatg taggttatgg aatcttgggc aagggccaag atccatgggc tatcctgtct 180
ccagcaaaat ggcaggaatt gattcataaa ttacaggaa attag 225
```

<210> 170

<211> 74

<212> PRT

<213> Streptococcus pneumoniae

<400> 170

```
Val Leu Arg Phe Ser Gly Leu Arg Gln Val Met Lys Met Asn Lys Lys
  1             5             10             15
```

```
Ser Ser Tyr Val Val Lys Arg Leu Leu Leu Val Ile Ile Val Leu Ile
      20             25             30
```

```
Leu Gly Thr Leu Ala Leu Gly Ile Gly Leu Met Val Gly Tyr Gly Ile
      35             40             45
```

```
Leu Gly Lys Gly Gln Asp Pro Trp Ala Ile Leu Ser Pro Ala Lys Trp
      50             55             60
```

```
Gln Glu Leu Ile His Lys Phe Thr Gly Asn
      65             70
```

<210> 171

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 171

cgagatctga tatctcacia acagataacg gcgtaaatag

40

<210> 172

<211> 43

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 172

gaagatcttc ccgggatca caaacagata acggcgtaaa tag

43

<210> 173

<211> 42

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 173

cgagatctga tatccatcac aaacagataa cggcgtaaag ag

42

<210> 174

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 174

cgggatcctt atggacctga atcagcggtg tc

32

<210> 175

<211> 23

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 175

ggatgctttg tttcaggtgt atc

23

<210> 176

<211> 82

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 176

catgatatcg gtacctcaag ctcatatcat tgcocggcaa tgggtgtgggc tttttttggt 60

ttagcggata acaatttcac ac

82

<210> 177

<211> 81

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 177

gcggatcccc cgggettaat taatgtttaa acactagtcg aagatctcgc gaattctcct 60
gtgtgaaatt gttatccgct a 81

<210> 178

<211> 24

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 178

cgccagggtt ttcccagtcg cgac 24

<210> 179

<211> 20

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 179

tcaggggggc ggagcctatg 20

<210> 180

<211> 22

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 180

tcgtatgttg tgtggaattg tg 22

<210> 181

<211> 26

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 181

tccggctcgt atgttggtg gaattg

26

<210> 182

<211> 5

<212> PRT

<213> Artificial Sequence

<220>

<221> SITE

<222> (3)

<223> Xaa=Any amino acid

<220>

<223> Description of Artificial Sequence: Cell wall
anchoring motif

<400> 182

Leu Pro Xaa Thr Gly

1

5

<210> 183

<211> 18

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 183

gcgggatccg ccaccatg

18

<210> 184

<211> 10

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 184

ttgcggccgc

10

<210> 185

<211> 43

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 185

cggatccgcc accatgggtc taattgaaga cttaaaaaat caa

43

<210> 186

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 186

ttgcggccgc caatgctaga ctaaacacaa gactca

36

<210> 187

<211> 36

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 187

cgcgatcca tgaaaaaat ctattcattt ttagca

36

<210> 188

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 188

ccctcgaggg ctacttccga tacattttaa actgtagg

38

<210> 189

<211> 35

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 189

cggatccgcc accatgagtc atgtcgctgc aaatg

35

<210> 190

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 190

ttgcggccgc ataccaaagc ctgacatcta cg

32

<210> 191

<211> 38

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 191

cggatccgcc accatgcaaa aagagcggta tggttatg

38

<210> 192

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 192

ttgcggccgc acccccatc ttaatccctt

30

<210> 193

<211> 40

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 193

cggatccgcc accatggagg tatgtgaaat gtcacgtaaa 40

<210> 194

<211> 32

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer

<400> 194

ttgcggccgc ttttacaaag tcaagcaaag cc 32

<210> 195

<211> 48

<212> PRT

<213> Streptococcus pneumoniae

<400> 195

Gly	Ile	Arg	Leu	Arg	Asn	Met	Leu	Phe	Lys	Ile	Trp	Pro	Ala	Val	Ala
1				5						10				15	

Leu	Val	Thr	Ser	Ser	Gly	Asn	Asn	Val	Ser	Met	Leu	His	Ser	Ile	Ala
			20					25						30	

Asn	Met	Gly	Gln	Leu	Thr	Leu	Gly	Thr	Gln	Cys	Gln	Thr	Val	Val	Val
			35					40						45	

<210> 196

<211> 11

<212> PRT

<213> Streptococcus pneumoniae

<400> 196

Gln Lys Ile Thr Met Ile Thr Phe Thr Phe Gln

1

5

10